

ON THE
PRODUCTION OF ISINGLASS

ALONG THE
COASTS OF INDIA,

WITH A
NOTICE OF ITS FISHERIES.

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P R E F A C E.

THE following observations on the Production of Isinglass in India, originated in a quantity having been sent to this country by the Earl of Auckland, Governor-General of India, for examination, and to be made known as a new export from India to Europe. But it has long been imported by the Chinese from Bengal. As the subject promised to be one of considerable importance, the Author was induced to examine into the Sources of the present supply of Isinglass for the markets, both of Europe and of China. Also to compare the mode of preparation in Russia with that adopted in Bengal, in order that improvements in the latter might be suggested. With this he has connected a general view of the Indian Fisheries, and the propriety of attending more extensively to the curing of Fish.

Attention was first called to Bengal Isinglass by an anonymous correspondent in Calcutta.

This was energetically followed up by Mr. McClelland, of the Bengal Medical Service. The curing of Fish had been previously suggested by Dr. Cantor of the same service. In investigating the subject, the Author was happy in discovering that Isinglass is at present exported in much larger quantities, and from a much greater variety of places, than is generally supposed. He has no doubt that its preparation may be so much improved, as to command much higher prices than it has yet obtained.

In conclusion, the Author has much pleasure in expressing his obligations for assistance to Mr. Yarrell, the distinguished Author of the History of British Fishes, to Mr. E. Solly, jun., for his Chemical Analysis, and to James Malcolmson, Esq., for specimens of Bombay Isinglass. Also to Messrs. Merry and to Mr. Emley, for information respecting, and for specimens of the different kinds of Commercial Isinglass.

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PRODUCTION OF ISINGLASS

ON THE

COASTS OF INDIA.

ISINGLASS is a substance well known in commerce, from its employment both in the arts and in domestic economy. It is the purest known form of animal jelly, and is obtained from the swimming bladder of a few kinds of fish, chiefly of the genus Sturgeon, the *Acipenser* of zoologists. This is indicated by some of its continental names, of which the English is no doubt a corruption;—thus, in German, Isinglass is called *Hausenblase*, from *hausen* the great sturgeon, and *blase* a bladder. It is exported in the largest quantities from the rivers of Russia, principally from those which flow into the Black and Caspian Seas, but also from the Sea of Aral and the Lake Baikal. The fishery affords employment to numerous individuals, and is still

Isinglass.

Isinglass, further important from the fish, both in their fresh and in their dried state, forming a great portion of the food of the inhabitants of Russia. Some, moreover, are exported, the eggs converted into Caviare, and the Sounds or Swimming-bladders into Isinglass.

History of. The preparation and commerce of Isinglass are not of recent origin. It is, indeed, remarkable for having been well known at the time of the Romans, and probably at even still earlier periods. For we learn from Pliny, as translated by Holland, "A fish there is named Icthyocolla, which hath a glewish skin, and the very glue that is made thereof is likewise called Icthyocolla (that is fish-glue). Some affirm that the said glue, Icthyocolla, is made of the belly and not of the skin of the said fish, like as bull's-glue. This fish-glue is said to be best that is brought out of Pontus,* the same also is white without any veins, strings, or scales, and very quickly melteth or resolveth." In comparing the different passages of this author, as well as referring to the accounts of previous (as Dioscorides) as well as of subsequent authors (see Hardouin's Pliny), where the same fish is mentioned, we find it described as being without bones and without scales, but

* Laudatur Pontica, candida, et carens venis squamisque et quæ celerrime liquescit.—Plinii, lib. 32, cap. xxiv.

provided with bucklers on its skin; also ^{Isinglass,} that its name is acipenser, and that it is found in the Danube and in the rivers falling into the Euxine. Hence, there can be no doubt that the substance was Isinglass, and that it was obtained from some species of Sturgeon. The ^{Commerce of,} continuance of this commerce from ancient times until the present day is a proof of the abundance as well as of the facility of the fishery. It may likewise be taken as an indication of the excellence of this Isinglass, considering that it is a substance prepared from an organ like the sound, so generally found in fishes. The whole quantity exported from Russia is considerable, but we will at present refer only to that which is imported into England. From ^{Quantity imported} Mc. Culloch's Commercial Dictionary, we learn that the imports in 1831 and 1832 amounted on an average to 1,984 $\frac{1}{4}$ cwt. a year. In the Report of the Committee on the Import duties, we see, that in the year 1839 there were imported 1,860 cwt. with additional 25 cwt. from British possessions. The former ^{Duty,} yielding a duty of £4,039, and the latter of £19.*

Considering the nutritious nature of Isin-

* Isinglass, the produce of and imported from any British possession, pays 15s. 10d., but otherwise imported a duty of £2. 7s. 6d per cwt.

Isinglass. glass and the facility it affords in making
 Consumption checked by high price elegant dishes for the sick and convalescent,
 as well as its general uses in confectionary
 and cookery, its employment in clarifying
 wine, beer, &c., and its utility also in some
 other of the arts, we should have expected a
 considerable increase in the importation, even
 from 1831 to 1839. Instead of this, there is,
 in fact, an actual decrease, though this is only
 to a small amount. There is no doubt, that the
 very high retail price of the best Isinglass,
 amounting to 18s., or even higher, per pound,
 must check its consumption in domestic eco-
 nomy, and necessitate only the inferior kinds
 being employed in the arts. Perhaps its being
 principally supplied from the more difficultly
 accessible parts of Russia may also have some
 effect. But the consumption limited by these
 causes, is still further diminished by substitutes
 being found for it, in a constituent of the ani-
 mal frame, of which it is itself the purest form.
 This is Gelatine, which is very abundantly dif-
 fused throughout the animal kingdom.

as Gela-
 tine ;
 distinguish-
 ing charac-
 ters of.

Gelatine is familiarly known to every one in
 the form of animal jelly, and is found in con-
 siderable quantity in different parts of a great
 variety of animals. It is distinguished from
 other animal substances, which it may resem-
 ble, by being soluble in hot, or rather boiling,

water, and forming a transparent and colourless solution, which on cooling becomes a solid tremulous jelly. This contains so large a proportion of water that it readily reliquifies on being warmed. Albumen, which, when liquid or in solution, may be mistaken for Gelatine, is distinguished from it by becoming solid when exposed to heat. This may be witnessed in the boiling of an egg, the white of which consists of albumen and was of a glairy consistence previous to the application of heat.

Gelatine, when pure, is transparent and nearly colourless, devoid of both taste and smell, easily preserved when in a dry state, but soon putrifying when moist. It is soluble in the different dilute acids as well as in the fixed alkalies, but the compounds formed with the latter, do not form a permanent lather with soap. A characteristic of gelatine is the copious precipitate which is formed from any of its solutions on the addition of tannin, as in the form of a decoction of oak bark, of galls, or of catechu. The precipitate forms a grey ductile mass which smells like tanned leather, with which it is indeed identical in nature.* The extent to which pure gelatine can unite with

Gelatine.

Properties
of.

* Corrosive sublimate does not precipitate gelatine, and therefore serves to distinguish it from albumen, as both are precipitated by galls and oak-bark.

Gelatine. ~~water~~ water, and still become a solid tremulous mass, has been ascertained by the experiments of Dr. Bostock. He found that when water contained no more than $\frac{1}{100}$ of its weight of Isinglass, it still stiffened completely on cooling, and even if it contained only $\frac{1}{100}$, the solution was evidently gelatinous when cold, though it did not become concrete. "One of the most remarkable properties of gelatine is," as Dr. Prout says, "its ready convertibility into a sort of sugar, by a process similar to that by which starch may be so converted."

Gelatine,
sources of.

It has been stated that gelatine is very abundantly diffused through the animal kingdom. Thus, though not contained in any of the healthy animal fluids, it is obtained in large proportion from skins, most of the white and soft parts of animals, as cartilage, tendon, and membrane; also from bone and horns. It is likewise found in large proportion in cartilaginous fishes, and forms the natural cement of many shells. From all these gelatine may be extracted by simple boiling in water, with different precautions in regard to cleaning. From bones it may be obtained by the same process, but with the assistance of pressure, and still more easily, if they have been first acted on by muriatic acid, to remove the phosphate of lime. The obtaining of gelatine may thus give rise to

a number of employments, which may be practised wherever these offals are obtainable, and the product, in the form of gelatine, can be turned to account.

The solution of gelatine, which, on cooling, becomes a tremulous mass, may by further evaporation be converted into a hard and brittle substance, well known by the name of Glue. This is made from the parings of hides or horns of any kinds, the pelts obtained from furriers, the hoofs and ears of horses, oxen, calves, sheep, &c. In France it is made from the raspings and trimmings of ivory, the refuse pieces and shavings left by button-mould makers, and from other kinds of hard bone. Size again is made by boiling down in water the clippings of parchment, glove leather, fish-skin, and other kinds of skin and membrane. This is used either alone or mixed with flour paste, gum arabic, or tragacanth, and employed by book-binders, paper-hangers, and painters in distemper.

Mr. Hatchett, many years since, ascertained that the viscosity and tenacity of the varieties of gelatine are qualities inherent in each, depending in one, on the age of the animal, the old giving a much stronger glue than the young | in another, on the substances by which it is furnished, as glue obtained from the skin

Gelatine.

Varieties
of.

Glue.

Size.

Viscosity
of different
kinds of.

Gelatine. is much stronger than the solid gelatine from bones, sinews, or any other part. Mr. H. further found that the force of adhesion of the glue from skin was generally proportionate to the toughness of the skin, those which were soft and flexible yielding a thinner gelatine than the hard bony skins, at the same time that they yielded it more easily.

**Commer-
cial kinds
of**

Considering the nature and sources of Gelatine and the high price of Isinglass, it is not surprising that the former should be frequently substituted for the latter. Hence we have different kinds of British gelatine and French gelatine as well as a Patent gelatine selling at retail prices of from 8s. to 12s., when the best Isinglass is selling for 18s. a pound.

**Gelatine as
an article
of diet.**

Gelatine is one of the principal constituents of most of the animal substances employed as food, and it is arranged by Dr. Prout among the albuminous group, all of which, he says, "differ from the oleaginous and the saccharine principles in this respect: that they contain a fourth elementary principle, namely azote." It forms one of the constituents of bone, from which it may be separated even ages after the animal has ceased to exist, as in the case of the bones of the Mammoth, from which gelatine was separated and tasted at the table of the Prefet of Strasbourg. As it is found in other

refuse animal matter, it has been proposed and ^{Gelatine.} employed, especially in hospitals and prisons, and some public institutions in France, as an article of diet in the form of soups, &c., which has by some been disparagingly called “soup of gaiter buttons.”

In some recent experiments, it has been attempted to be proved that gelatine or animal ^{Nature of food.} jelly affords no nutriment, or not sufficient to support the life of the more highly developed animals. Similar experiments have formerly been made with other articles of diet, such as Sugar and gum, and now with Gelatine, Albumen, Fibrine, and Fecula, and all with the same results, so as to prove that none of them singly are calculated to afford nourishment and support life. But, in fact, man was not intended to live upon any one of these substances alone, but upon a mixed diet. So Flesh, Bones, and Gluten, being compound bodies, supported life perfectly. Dr. Prout arranges all nourishing substances, capable as they are of assuming an infinite variety of forms, under the three heads, or staminal principles, of the Saccharine, the Oleaginous, and the Albuminous group ;* and says, as all the more perfect organized beings feed on others that are orga-

* Gelatine he considers as the least perfect kind of albuminous matter existing in animal bodies.

Isinglass. • nised beings, their food must necessarily consist of one or more of the above three staminal principles. Hence, the diet of the higher classes of animals and of man, to be complete, must contain more or less of the three staminal principles, and therefore Gelatine may be one of them.

Properties
of.

Isinglass, as already stated, is one of the purest forms of animal jelly, and is brought to market in different forms, sometimes in that of simple plates, at other times rolled up in different shapes, or cut into fine threads. When of good quality, Isinglass is of a whitish colour, thin and semi-transparent, but tough and flexible, destitute of taste as well as of smell. The inferior kinds are thicker, yellowish coloured, opaque, and sometimes having a fishy smell and taste. When placed in cold water, it becomes soft, then swells, and if held up to the light in this state is opalescent. In boiling water, Isinglass is entirely dissolved, with the exception of a very minute proportion of impurities, which Mr. Hatchett ascertained did not amount to more than 1.5 parts in 500; these consisted of earthy residue, which appeared to be the phosphates of soda and of lime. A solution of one part of Isinglass in 100 of water when cooled down assumes the form of a clear and colourless jelly; which is a com-

pound of pure gelatine and water. Though ^{Isinglass.} the best Isinglass is thus completely dissolved in hot water; yet much of that found in commerce does not become so, in consequence of the presence of albuminous parts.

With respect to the action of acids and alkalies, as well as of tannin and other chemical ^{Chemical re-agents.} re-agents, the effects are the same as those produced on a solution of gelatine.

Isinglass, being mild and unirritating in nature, and at the same time nutritious, is much employed as an article of diet for the sick and convalescent, and the fine shreds into which it is cut and kept in shops, give great facilities for making a jelly in the shortest possible time. This can be made as palatable and nourishing as any by the addition of sugar and milk, acids or spice; about one-third or half an ounce is sufficient for a pint of water. It may also be taken in the form of a soup with the addition of salt, spices, and sweet herbs, or it may be employed medicinally as an ^{Medicinally.} emollient and demulcent, either externally or internally. The best kinds of Isinglass are alone employed in articles of diet and for the best confectionary, ^{In confectionary.} being added in small quantities to other, especially vegetable jellies, to give them a tremulous appearance. But gelatine is now frequently substituted.

Isinglass. •
Used in the
arts.

In fining.

Extensive-
ly by
brewers.

Process of
fining.

Isinglass is also employed in making court-plaster, which, in France, is called *sparadrap d'Angleterre*; it is a thin coating of Isinglass with a little tincture of benzoin spread on black sarcenet. It is also employed for giving ■ lustre to some kinds of woven fabric; but it is more extensively used for clarifying different liquors, such as wine, beer, and coffee, than for any other purpose. The inferior kind, called cake Isinglass, being brownish coloured, and having an unpleasant odour, is only employed in the arts, and for the purposes of glue.

The great consumption of Isinglass, necessarily however of the inferior kinds, is chiefly by the brewer, in the process of fining. This he effects by the use of Isinglass, which he dissolves in sour beer to the consistence of thick mucilage. A little of the solution being added to the liquor to be clarified, causes the subsidence of all the suspended matter in the course of a few hours, when the liquor remains perfectly transparent. The sounds of codfish are said to be employed for the same purposes, though I cannot learn that many are imported, except in a salted state, for food. The white of egg and the serum of blood will also produce the same effect as far as transparency is concerned. The mode of action of these substances

in this process, is usually explained by sup- Isinglass.
 posing, that the floating particles become en-
 tangled within the Isinglass, ■ in the meshes
 of ■ net, and, uniting with it, form insoluble In Ising.
 compounds, which precipitating, are carried
 downwards, and thus leave the supernatant
 liquor free from all impurity. Mr. Donovan
 explains this process, by supposing that the
 substance added, by dissolving in the water,
 lessens its affinity for the suspended particles,
 which thus set free, subside by their own spe-
 cific gravity.

Such being the uses of Isinglass, and its Sources of.
 consumption being no doubt limited by its
 high price, it is desirable to examine more
 minutely into the present sources of supply,
 and to inquire whether efficient substitutes, in
 the form of new varieties of Isinglass, may not
 be obtained from other parts of the world.

It has been mentioned that Isinglass is Sturgeons.
 chiefly obtained from the rivers of Russia
 which fall into the Black and Caspian Seas,
 and that it is principally formed of the Swim-
 ming bladders of fishes of the genus Acipenser
 or Sturgeon. These belong to the great sub-
 division of Cartilaginous fishes, which are so Cartilagi-
 nous in
 nature.
 named from the skeletons being devoid of bony
 fibres, and chiefly composed of cartilage, with
 the little calcareous matter deposited in small

Sturgeons, grains. Among these, along with the sturgeons, are arranged the Shark, Ray, and Skate, as well as the Lamprey and Myxine, the most imperfect of fishes, and indeed of vertebral animals.

Characters of. The Sturgeons are easily distinguished by having bony bucklers implanted in longitudinal rows on their skin, and by having their heads, to use Cuvier's expression, similarly cuirassed. The mouth is small, devoid of teeth, and placed under the muzzle. They resemble ordinary fish by having their gills free, which have but a single orifice, and by being oviparous. Internally, they are characterized by having a large swimming-bladder, which communicates by a wide hole with the œsophagus. They ascend several rivers in great numbers from different seas, and thus give rise to very profitable fisheries, as their flesh is in some countries esteemed as food, both in a fresh and salted state, while their eggs form Caviare, and their sounds Isinglass.

The species yielding useful products.

As the genus *Acipenser* is known to consist of several species, it might be expected that Isinglass is yielded by more than one of them. This is found to be the case with several, though all the species of the genus have not yet been accurately determined. A few have been known from early times; several were determined by Pallas, no less than nine are figured and de-

scribed in the Medical Zoology of Brandt and Ratzburg.* Sturgeon,
Species of.

* Medizinische Zoologie von J. F. Brandt und J. T. C. Ratzburg. Berlin, 1829.

The following are the species which are best known, in consequence of their being caught and valued for their products:—

The Common Sturgeon (*Acipenser Sturio*)—Br. and R. tab. iii. fig. 1,—which is usually about six or seven feet in length, and is found in the Atlantic Ocean, on the coasts of France and of England, in the North Sea, Baltic, and German Ocean, whence it ascends the rivers of France and Germany. It is occasionally caught in the Thames, and used formerly to be considered a royal fish and much prized, probably on account of its rarity. The flesh, somewhat resembling veal, is eaten both in a fresh and salted state. The roes yield an excellent Caviare, the Swimming-bladders may yield Isinglass, but are not applied to use, probably because too few are obtained at a time.

The Great Sturgeon (*Acipenser Huso*)—Br. and R. tab. i. fig. 1. Suppl. tab. i. fig. 1,—called *hausen* or *husen* by the Germans, and *beluga* by the Russians, attains a great size, being often twenty feet in length. It is an inhabitant of the Caspian, especially of the quieter bays and gulfs, and of the rivers which flow into it, and of their tributaries. It ascends these great rivers from the sea, towards the end of winter when they are frozen, in order to deposit its spawn in spring, and is said to return to the sea in the autumn. The fishery is performed by contract. Many of the fish caught are kept in pieces of water, and are again brought up in winter through holes made in the ice. Then the mass of the fish becomes frozen, when it is distributed in this, as well as in a salted and pickled state, through the

Extent
of fishery.

Fishery occupies a great number of the people, affords food to many of the inhabitants, and

interior of Russia. The Roe and the Isinglass are at the same time separated. A single fish is said sometimes to yield ■ much ■ 120 pounds of roe, with which caviare is prepared. This is principally consumed in Russia, Germany, Italy, and by the Greeks during their long fasts; but lately the consumption has much increased in England; that made by the Cossacks of the Oural is usually preferred. The Belugas also afford a considerable portion of oil, and the whole fish yields a considerable revenue to Russia. About seven poods and a half of Isinglass are obtained from 1,000 fish. The roe, or caviare, of 1,000 fish weighs 100 pood, or 4,000 pounds. This species, according to Dr. Martius, yields Leaf Isinglass of three qualities—fine firsts, firsts, and seconds.

The Osseter (*A. Guldenstadtii*) Br. and R. tab. iii. fig. 2. This species is widely diffused, being found in the Black and Caspian Seas and the rivers which flow into them, as well ■ in their tributaries; also in Lake Baikal. It yields about one-fourth of all the Caviare and Isinglass of commerce. The caviare is one of the best kinds, and is preferred to that of the Belugas. It is probably this species which is called the Sturgeon in the above situations. One thousand produce two poods and a-half of the best Isinglass, and the same number of fish not more than 60 poods of caviare or roe. Both staple and leaf Isinglass are yielded by this species. The varieties of the former are Patriarch, Astrachan, and Astrachan firsts, seconds, and thirds, also leaf and book at Sallian (Martius).

The Sterlet (*A. Ruthenus*)—Br. and R. tab. ii. fig. 2,—is also very generally diffused, being found in the Caspian and Black Seas, as well ■ in the Arctic Ocean, in many of the rivers which flow into them, and also in the tributa-

is the source of considerable revenue to Russia. Those of the Volga are very productive, and consist of the Carp, the Pike, the Trout, the Herring, and of the Pilchard; but to a still greater extent of the Sturgeon, Beluga, and Salmon, besides of the Lampreys and Mackerel in the Crimea for pickling.

Value of
fisheries.

M. Schnitzler says that the sturgeon fishery is of considerable value: 1,850,500, caught in the year 1793, in the Volga, near Astrakhan, yielded 124,970 poods of caviare and 3,375 poods of Isinglass. The net value of the Russian fisheries is calculated by him to amount to more than 10,000,000 rubles.

Of that of
Sturgeons.

ries; likewise in Lake Baikal. It was transferred by Frederick the Great to the Lakes of Pomerania, and by Frederick the First of Sweden into the Malar and Hammarby Lakes. Its flesh is prized. It yields the best Isinglass, especially for inlaid works. In commercial language, leaf and book (first and second), also staple Isinglass, are yielded by this species, and its roe yields caviare.

The Sevruga or Sewrjugh, Starred Sturgeon (*A. stellatus*, Pallas)—Br. and R. tab. iii. fig. 3,—is a native of the Caspian and Black Seas and of their tributary rivers, also of the Lake of Aral. One thousand Sevrugas produce one pood and a quarter of superior Leaf Isinglass, and sixty poods of the best caviare.

Other species figured are *A. brevirostris*, tab. i. fig. 2. *A. Schypa*, tab. i. fig. 3, and Suppl. tab. i. fig. 2. *A. Ratzeburgii*, tab. i. fig. 3. *A. Lichtensteinii*, tab. ii. fig. 1, and *A. maculosus* and *oxyrhynchus* of N. America, described,

Value of
the Stur-
geon Fish-
ery.

The following statement of the produce of the Russian fisheries of the Caspian and its tributary streams, in 1828 and 1829, is extracted from the official Report made to the Minister of Commerce at St. Petersburg,

Year.	Number of Per- sons em- ployed in fish- ing.	Stur- geon.	Sevruga.	Beluga.	Caviare.	Fish Cartilage	Isinglass.
1828	8887	43,035	653,164	23,069	Poods, lb. 34,860 1	Poods, lb. 1,207 38	Poods, lb. 1,225 27
1829	8760	68,325	697,716	20,391	28,420 7	1,173 20½	1,092 22

Estimated
by Pallas.

Pallas, in his Travels in the Southern Provinces of the Russian Empire, states that the emoluments of the fisheries in the Volga and the not less productive shores of the Caspian Sea, may be considered as the principal support of the inhabitants of Astrakhan. It would be difficult to find in the whole world, except on the banks of Newfoundland, a more productive fishery, or one more advantageous to the government, than those on the Volga and the Caspian Sea united. During the fasts of the Greek church and the weekly fast days, which together amount to at least one-third of the year, this fishery affords the principal food to the whole European part of Russia, and its populous capitals. Many thousands of individuals are employed and acquire wealth

either by fishing and conveying the fish on rafts or sledges, or by selling them in the markets. Value of
the Stur-
geon Fish-
ery.

The whole value of the sturgeons of different kinds caught in the waters of Astrakhan and the Caspian Sea, amounts to the annual sum of 1,760,405 rubles.* To this must be added the value of the Persian fishery at Sallian, which, when established only a few years, yielded annually upwards of 200,000 rubles. "It might be still more lucrative, if the injudicious fishermen would preserve the great number of fish, instead of throwing them into the sea as useless, after having collected their roes and air-bladders."

"The most valuable production of the sturgeons," Pallas continues, "is the Isinglass prepared from their air-bladders. According to the list of exports printed by the English factory at St. Petersburg, there has been exported in British vessels, from 1753 to 1786, Of the
Isinglass. Exports. from 2,000 to 3,000; in later years, usually upwards of 4,000, and in 1788, even 6,850 poods of that article. The exportation to other countries has also amounted, within these

* Products of the fisheries of the great sturgeon	
amount to	341,535
Little sturgeon.....	497,545
Sevrugas	921,325

Isinglass,
commerce
of ;

few years, to above 1,000 poods. The large and almost incredible demand, has, at the same time, tended to increase the price of the different qualities of this commodity at Astrakhan itself ; and on the exchange of St. Petersburg, whence Isinglass of the best quality, so late as the year 1778, did not exceed the price of 30 rubles a pood, it has lately been advanced to 90 rubles."

yielded by
other
fishes.

Isinglass being prepared from the swimming-bladder of certain fishes, and this being an organ generally, though not universally, diffused through that class of the animal kingdom, it seems remarkable that it should not be more generally employed, for the purpose of yielding so valuable a commercial article. The fact, however, is, that though Isinglass of the finest quality, and in the largest quantities, is yielded by, it is not confined to, the sturgeon tribe, for even in Russia the *Silurus Glanis*, species of *Cyprinus*, and Barbel yield it, and we meet in commerce with Brazilian, New York, and Hudson's Bay Isinglass.

In Russia,
&c.

Brazilian.

The fishes which produce it on the coast of Brazil have not been ascertained. Camera supposed them to be species of *Gadus*.* Mr.

* Notice sur l'ichthyocolle fournée par différentes espèces de gadus que l'on pêche au Brésil.—La Médecine éclairée par les Sciences Physiques, i. p. 364.

135.F203



Yarrell informs me that no species of *Gadus* is caught on the coast of Brazil. The common cod prefers water of a low temperature ; though found all the year about Boston, it migrates northward from New York when warm weather begins. The fishes producing Isinglass in Brazil, he further writes, are probably species of the genera *Pimelodus* and *Silurus*, or of closely allied genera.

Brazilian
and North
American
Isinglass.

The Brazilian Isinglass is imported from Para and Maranhão. It is very inferior in quality for domestic purposes to the best imported from Russia, which sells for 12s. per lb., and the other from about 3s. to 3s. 6d., and even as low as 9d. per lb. It is in the form of Pipe, Block, Honey-comb, Cake, and Tongue Isinglass, the last formed of a double swimming-bladder. The specimens shewn to Mr. Yarrell appeared to him to belong to seven different species of fish.

The Isinglass obtained from North America, in the form of long ribbons, is produced, according to Dr. Mitchell, by *Labrus squalus*, at New York, called weak fish, which is about fifteen inches in length, and above six pounds in weight, forming one of their most abundant fish and the principal supply of their tables. One author states that its thick silvery swimming-bladders are pressed, and

N. American

Fish yield-
ing Ameri-
can Isin-
glass.

another that the sounds of the Hake (*Merluccius vulgaris*) are also pressed between iron or wooden rollers to form thin Isinglass.

The Labrus Squeatecague is *Otolithus regalis* of Cuvier (the *Johnius regalis* of Bloch), of the tribe *Sciænoides*. These are allied to the Perches, but have more variety and a more complicated structure in their natatory bladders; almost all are good for eating, and many of superior flavour. To the genus *Otolithus* also belong some Indian fishes, as *O. versicolor*, Cuv. and *O. ruber*, Cuv., the peche pierre of Pondicherry, called there *panan*, which is fifteen inches long, and caught in abundance all the year, being esteemed as food. This genus is closely allied to *Sciæna*, of which species, as *S. Aquila* (*maigre* of the French, and *umbrina* of the Romans), &c., are found in the Mediterranean. *S. Pama* or *Bola Pama* of Buchanan resembles the *maigres*, but has a singular natatory bladder. When twelve or fifteen inches long, it is erroneously called *whiting* at Calcutta, and furnishes a light and salubrious diet. It is caught in great abundance at the mouths of the Ganges, but never ascends higher than the tide.

Allied to
Indian
Fish.

Isinglass
from the
Cod.

In New England, the intestines of the common Cod (*Morrhua vulgaris*) are cut into ribbon Isinglass: in Iceland also the Cod is said to

yield Isinglass, so also the Ling (*Lota Molva*). Mr. Yarrell informs me that he has no reason to believe that Isinglass is so prepared, at least in the southern parts of this country. The fish being brought alive in well-boats as far as possible :- cod and also ling sounds are mostly preserved soft, by salting, and are dressed for table as a substitute for fish.

Isinglass
from the
Cod and
Ling.

Hence we see that Isinglass is not confined to the tribe of sturgeons, nor to the rivers of Russia, but that it is found in fishes on the warm coast of Brazil and the cold one of Iceland. It would not, therefore, be surprising to find it yielded by some of the great variety and shoals of fishes, on the long extended coasts of the British Empire in India. Some experimental quantities have, in fact, already been imported from Bengal into this country within the last year. Indeed, from the accounts published, and the additional facts which will be adduced, it will appear that a trade in Isinglass, and in some of its substitutes, has long been established on the coasts of India.

Isinglass
from India

long an
article of
commerce.

The first who appears to have drawn attention to this subject, was an anonymous correspondent in Parbury's *Oriental Herald* in January, 1839, who stated, that the Chinese had long been engaged in a trade with Calcutta in Isinglass. Also, that this was afforded

Described
by anony-
mous cor-
respon-
dent.

Indian
Isinglass.

by ■ fish called *sulleah* in Bengal, and that from half a pound to three-quarters of a pound was obtained from each fish.

Described
by Mr. Mc
Clelland.

In consequence of this notice, the attention of Mr. McClelland of the Bengal medical service was turned to the subject, and he has pursued it with a degree of energy and intelligence, which renders it extremely probable that Isinglass may be regularly established as an article of export from Bengal to Europe.

The fish
yielding
this Isin-
glass.

Mr. McClelland's first paper was published at Calcutta in June, 1839; in the Journal of the Asiatic Society, vol. viii. p. 203. In this he informs us, that having procured a specimen, from the bazar, of the fish yielding the Isinglass, he was surprised to find it to be a species of *Polynemus*, or paradise fish, of which several species are known for their excellence as articles of food. Of these he adduces the Mango Fish or tupsce mutchee of the Bengalees (*Polynemus Risua*, Buch.) as a familiar instance, though this is remarkable as being without ■ swimming-bladder: while the other species have it large and stout. These occur in the seas of warm climates; five are described by Dr. Buchanan in his Gangetic fishes, but only two are of considerable size, occurring in the estuary of the Hoogly; and probably in those of the Ganges. One of these, with

A species
of polyne-
mus.

Other spe-
cies in In-
dian Seas.

another large species, is also described by Dr. Russell in his work on the fishes of the Madras Coast. That figured in tab. 184, and called *maga-booshee*, is *Polynemus uronemus* of Cuvier, while the *maga-jellee*, tab. 183, named *P. tetradactylus* by Shaw, is probably *P. Teria* of Buchanan. Both, but especially the first, Russell says, are esteemed for the table, and called *row ball* by the English.

Mr. McClelland ascertained that the species affording the Isinglass, is the *Polynemus Sele* of Buchanan, *sele* or *sulea* of the Bengalese, described but not figured in his work on the Gangetic fishes (p. 226). Mr. M. has, however, published in the Journal of the Asiatic Society of Bengal, a figure from Dr. Buchanan's unpublished collection of drawings, which are kept at the East-India Company's Botanic Garden at Calcutta. This figure, he states, conveys a good representation of the Sele about half the size of a specimen, from which he obtained sixty-six grains of Isinglass. Dr. Buchanan describes the Sele as affording a light nourishing food, like most of the fishes which he has called *Bola*, but as inferior to many of them in flavour. It is common in the estuaries of the Ganges, and is often found weighing from twenty to twenty-four pounds; and may perhaps be the *Emoi* of Otaheiti, the *Polynemus lineatus* of

Indian
Isinglass.

Species
yielding
Isinglass in
Bengal.

Isinglass.

La Cepede, the *P. plebeius* of Bronssonet. This, according to Bloch, is by the English called king-fish, and is the *Kala mine* of John from Tranquebar, and abundant in the Kistnah and Godavery. Buchanan further states, that the Sele has a strong resemblance to the above-named *maga-booshee* of Dr. Russell.

Whether yielded by any other species?

As the anonymous author above referred to, states that from half a pound to three-quarters of a pound may be obtained from each fish; Mr. McCleland supposes either that *P. Sele* attains a much larger size than twenty-four pounds, the limit given to it by Buchanan, or that Isinglass is also afforded by a far larger species, namely *P. tetradactylus*, *Teria* or *teriya bhangam*. This, as we have seen, is identical with the *maga-jellee* of the Coromandel Coast, and which Buchanan often saw six feet long in the Calcutta bazar, and was informed it sometimes equalled 320 pounds avoirdupois in weight. It is considered by the natives as a wholesome diet, although seldom used by Europeans.

Species of Polyne-mus.

Caught in large quantities.

Mr. McCleland says he has frequently seen them of a uniform size, that must have weighed from fifty to a hundred pounds at least, loading whole cavalcades of hackeries (carts) on their way to the Calcutta bazar during the cold season. Both the Sele and the *teria*.

bhangan must consequently be very common there from November to March. Indian Isinglass.

Whether both species have natatory bladders was doubtful when Mr. M. wrote his paper. But from the large quantities and size of the Isinglass which has been produced in the Bay of Bengal, it is probable that it is yielded by both the above species. *P. Sele* is supposed to be a variety of *P. lineatus*, which is said to be common on all the shores to the eastward; but if so, Mr. M. says, it seems strange that the Chinese should send for it to the Hoogly. The same might, however, be said of the Cod, which, though caught in abundance on the coasts of Great Britain, is also diligently sought for on the banks of Newfoundland. He also inquires whether *Polynemus Emoi* and *P. plebeius*, supposed by Buchanan to correspond with his *Sele*, contain the same valuable substance? and do either of Russell's species, the above-named *maga-booshee* and *maga-jellee* (Indian fishes, 183-184), yield it? These questions are very interesting, in connection with the information which will be afterwards given, respecting the extent of the fishery along the coasts of India, and of the export to China of large quantities of a substance which is no doubt one form of Isinglass. Do other species yield Isinglass?

Indian
Isinglass.

Sulliah
of Dr.
Cantor

Dr. Cantor, in a paper read before the Royal Asiatic Society, on some Indian fishes found in the Bay of Bengal, says, "To the genus *Polynemus*, I shall add a species called by the natives *sulliah* or *saccolih*. It enters the mouths of the Ganges in shoals, and is equally sought by Europeans and natives for its excellent flavour, which much approaches that of salmon. I have seen it from three to four feet in length and eight to ten inches in depth. It appears equally plentiful all the year round, which is also the case with a nearly allied species, the *Polynemus quadrifilis* of Cuvier." In reference to this passage, Mr. M. says, "I am not sure that the species of *Polynemus*, Dr. Cantor particularly refers to in his paper as the *sulliah* or *saccolih*, is not the very fish that affords Isinglass; if so, it appears to be considered by Dr. Cantor as a new species."

Isinglass
from other
genera.

In his letter, dated 17th February, 1841, Mr. McClelland says, "that besides the *Polynemus* Sele, the fishes described by Dr. Buchanan, under the name of Bola, all afford a considerable quantity of Isinglass. Some of the specimens sent are from a species of this genus. Several of the Siluridæ also afford it in large quantities, especially the species marked *Silurus raita* by Dr. Buchanan." This is an important fact, as it is probable (v. p. 23)

that a *Silurus* yields a Brazilian Isinglass; so *S. Glanis*, in the South of Russia, yields Isinglass of several kinds, as Staple, Leaf, and Book (an Samovey?) which are esteemed in England. It may, therefore, be produced of good quality by Indian species of *Silurus* and *Pimelodus*. Indian Isinglass.

The first sample received at the India-House was sent to the author by Mr. Cantor, of the house of Cantor and Co., of Calcutta, with a note, dated 30th October, 1840, stating that it was a specimen of a consignment sent by his house in Calcutta. Specimens received from Mr. Cantor.

The next samples were forwarded by Mr. Rogers to Mr. Melville, the Secretary of the East-India Company, for the Court of Directors, with a note stating that they were curious as being the first importations of Isinglass from India; also that one of these was valued at 4s., and another at 1s. 8d. per lb., and that the importation from Bengal was expected to exceed fifty tons during the year. From Mr. Rogers

This note was accompanied by a memorandum from Mr. G. Remfrey, stating that No. 1 was Isinglass simply taken out of the fish and dried by exposure to the sun; and that No. 2 was the same substance partially prepared, by being cut open, the interior membranes taken out, washed with cold water, and beat on a Note by Mr. Remfrey

Indian
Isinglass.

piece of wood; by which means it is flattened, extended, and loses weight. He further states that another description of Isinglass is common at Calcutta. This is prepared by the natives to imitate, and is sold for local consumption for one-fourth of the price of, European Isinglass. They take the above Isinglass, when in its freshest state, and pull it into shreds with their fingers, then dry it in the sun, and mix with it small portions of chunam (powdered lime) to preserve it from insects, damp, &c.

Unknown
to Euro-
peans, but
exported
by Chi-
nese.

Mr. Remfrey also adverts to the fact, that while Europeans were unacquainted with the existence of this trade, the Chinese had from time immemorial been supplied with Isinglass from Bengal. He says, that when in Calcutta he was informed that the natives of the eastern countries were in the habit of coming through the Sunderbuns to a large village, near the salt-water lake, six miles south-east of Calcutta. There they obtain as much as 800 to 900 maunds of this Isinglass for the China market, and pay for it 25 to 40 rupees per maund. The Chinese, it is surmised, use it for their soups, glues, &c. It is imported in the same state as specimen No. 1. It was at this village that both the samples sent were purchased. The Chinese are said also, in one account, to bring back to Calcutta the Isin-

glass which they had exported from its neighbourhood, but in an improved form, and at a considerable advance of price.

Bengal
Isinglass
known in
China.

. Isinglass, the produce of Bengal, though apparently unknown to the merchants and European residents of Calcutta, has been celebrated in China from the earliest times. Dr. Lumqua, a Chinese physician, long resident in Calcutta, informed Mr. McClelland that the Bengal *Fish-sago* (as Indian Isinglass is called in China) is well known throughout the empire. Also that nothing could surpass his surprise, on his arrival nearly twenty-five years since in Calcutta, when he found that, with the exception of his countrymen, who carried on the trade, no one appeared to know or care any thing whatever for the article in question.

The next quantity received, was forwarded by the Governor-General, the Earl of Auckland, to the Court of Directors, as samples of an article of considerable interest; in order that the Court might, if they saw fit, obtain the opinion of competent persons, as to the purposes and probable extent to which Bengal Isinglass of the description sent could be applied.

Specimens
sent by the
Governor-
General,
Lord Auck-
land.

These samples had been prepared by Mr. McClelland, who forwarded forty-six seers of Bengal Isinglass, in different forms, obtained

Prepared
by Mr. Mc
Clelland.

Bengal
Isinglass
prepared by
Mr. Mc
Cleland

chiefly from the Polynemus Sole, with other specimens from the species of Bola already alluded to. He states that his attention had for two years been directed to this subject, to ascertain the extent to which Isinglass may be procured, and the means by which its manufacture may be improved.

Cost and
sale of a
sample for-
merly sent.

Mr. McCleland also informs us, that in order to ascertain the value of the article (merely stripped of all impurities calculated to injure its quality, without any regard to appearance), a considerable quantity had been sent to England. An account having been received of the sale, it appears that this Isinglass realized only 1s. 7d. per lb., which was considerably under its prime cost. Forty-four maunds and ten seers of Fish Sounds having been bought for 40 rupees a maund, required an expense of 100 rupees for cleaning, after purchase from the fishermen, thus costing altogether about 1s. 1d. per lb. This quantity, or 2,235 lbs. at 1s. 7d. per lb., realized £176. 18s. 9d.; but the charges in India and in England, consisting of packing, demurrage, freight, insurance, shipping charges, export and import duties, warehouse, brokerage, commission, interest, &c., were so heavy, that the whole did not realize quite one-third of the outlay.

Present
samples

The kinds now sent consist, firstly, of the

Isinglass in entire pieces; secondly, of the same cut into fine shreds; and, thirdly, some to which a little chalk had been added, to preserve it dry and free from insects. Also four specimens of Isinglass from the Bola Fish.

Bengal
Isinglass,
kinds of.

These several samples of Bengal Isinglass differ considerably from each other in appearance. Those first received from Messrs. Cantor and Rogers were in oval-shaped pieces, about nine inches in length, and five in breadth, and at least one-quarter of an inch in thickness, opaque, of a brownish colour externally, but beautifully white, even silky-looking, when thin pieces were stripped off. These specimens had little taste or smell, but as they were only few in number, the smell could not be judged of so well as when in bulk.

Appear-
ance of.

Messrs.
Cantor and
Rogers's
specimens.

Mr. McClelland's specimens vary in length, being from six to twenty-four inches long, about three and four inches broad, and from one-sixth to one-tenth of an inch in thickness. Whitish in colour, rough in some places apparently from the adhering pieces of membranes stripped off, smooth and translucent in others, and occasionally nearly transparent in some, having something of an oily feel when rubbed, and exhaling a fishy odour when in mass. Some of the specimens are whitish in appearance, from a little adhering chalk, which was sprinkled on

Mr. Mc
Clelland's
specimens.

Bengal
Isinglass.

Appear-
ance of.

Kinds suit-
ed to En-
glish mar-
ket.

Sale of
samples.

the soft substance to assist its drying and to prevent the masses adhering together. As this is easily brushed off, and is, moreover, insoluble in water, it will not in any way interfere with the article when brought into use.

The Isinglass cut into threads is unsuitable for the English market, notwithstanding that Isinglass for retail is cut into fine threads, as more convenient for general use, and for making jellies and soups, in consequence of the extensive surface, which is exposed, rendering it more easily and quickly soluble. But there is a great prejudice in the wholesale market to buying things in a cut or powdered state, in consequence of the innumerable methods adopted, for falsifying and adulterating almost every drug. Machinery is used in London for cutting the Isinglass into threads of any degree of fineness, and as it is impracticable at present to rival this in India, besides having to contend against a prejudice if sent in this state, it is preferable, and will be cheaper, to prepare the article and send it as sheet Isinglass, that is in the form of the slit sounds themselves, or their purest membrane washed, cleaned, and dried in the best manner.

It has been stated that several parcels of Isinglass from Calcutta have already been sent to the London market. Though we are not

acquainted with the prices which all have brought, yet we have the fullest evidence respecting the cost and the out-turn of one large sample; and that the price was small, compared even with the original outlay. But other parcels have sold at a higher price.

Bengal
Isinglass.

Many circumstances tend to produce an unfavourable effect on the price of a new article exposed for sale, independent of its intrinsic value. In the first place, it is new and unknown; this will of itself repel many ordinary purchasers, because they are unacquainted with its peculiarities, and do not consider it worth the trouble and expense of submitting to experiment, more especially as they do not know whether they may meet with it again as a regular article of commerce. Others, again, who are willing to submit it to trial, will only do so, when they can obtain it at a sufficiently cheap rate, and therefore take advantage of its unknown condition to depreciate its value. Besides, there is always a certain degree of trouble and risk with a new substance.

Objections
to a new ar-
ticle.

The Indian Isinglass prepared as it is from the sounds of a fish, undoubtedly possesses all the general characteristics of Isinglass, for which reason it is valued by the Chinese, and imported into their country from the mouths of the Ganges. Yet it has some positive defects,

Bengal
Isinglass,
properties
of,

Bengal
Isinglass

which, though interfering but little with its general properties, may give a colour to the objections of purchasers.

Proportions of as a
jelly.

That this Bengal Fish Sound does possess the general properties of Isinglass may be proved to the satisfaction of any one who will boil a portion of it for a little time in water. If, after straining, it be set aside to cool, it will be found to congeal into a clear, tasteless, transparent jelly, which, when sweetened and flavoured in the usual manner, can hardly be distinguished from many other kinds, as has been observed both by Mr. Yarrell and the author

Appearances objected to.

Notwithstanding this, some may object to its appearance, as many of the specimens are but imperfectly prepared; but others are fine and transparent enough to be mistaken for specimens of Russian Book Isinglass. It is not surprising, if without practical experience and with necessarily imperfect knowledge, respecting the best modes of preparing Isinglass on the banks of the Volga, the fishermen on those of the Ganges should not at first succeed, in rivalling this anciently established manufacture. Taking all things, however, into consideration, the success of the first attempts is considerable, and assures us how much more is likely to attend the efforts of those who follow Mr. McClelland's example, when in-

formed of the objections made in the London market to the first attempts. The preparation of this Isinglass, however, appears excellent when compared with the simply dried sounds, characteristic of the Brazilian, which has also the disadvantage of some disagreeable smell, and of portions being insoluble albumen.

Bengal
Isinglass.
Compared
with Bra-
zilian.

The defective preparation of Bengal Isinglass is especially observable in its still retaining something of the fishy smell, as well as in being in part insoluble, apparently from some portion of the albuminous membranes still continuing adherent to the purer gelatinous parts. It is probable, that by increased care in cleaning, and drying by exposure to air, some of those defects may be removed, especially as we shall observe, in comparing the two processes, that much greater care is bestowed on the preparation in Russia than in India.

May be
much im-
proved.

These objections made to the Indian Isinglass in the London Market, and known to many, are embodied in the following letter from experienced Brokers, to whom the author submitted samples of this Isinglass.

TO DR. ROYLE.

SIR,—The three samples of Isinglass are of a quality not unknown to us as from the East Indies, and have hitherto been received in the whole or entire sheet state, and not

Bengal
Isinglass.

Bengal
Isinglass,
Brokers'
opinion
respecting
it.

cut. In consequence of the article not having had sufficient care bestowed upon it before being subjected to the process of drying, so as to remove the unpleasant fishy smell, it is impossible to bring it into use here for culinary purposes, and thereby supersede the Astrachan sorts now in use, and selling at 10s. to 12s. per lb. The East Indian will be only available for brewers' use, and then it must be sweeter and of better flavour than the present samples. The Brazil is the description taken by brewers, and is worth 2s. 6d. to 3s. 6d. per lb., but is quite free from the objectionable smell, as is also the Samovy, which is of nearly the same value, and applied to similar purposes.

We sold a parcel of East Indian in sheet at public sale in November 1840, at 2s. 6d. per lb. in bond, but I think that 3s 6d. is nearer the price it would now bring.

THOMAS MERRY & SON.

16, Laurence Pountney Hill,
26th August, 1841.

P. S. One of the cut samples has been bleached, but is of no more value than the unbleached one.

Mr. Emley, also an experienced Broker, in examining the specimens found some which he considered very well prepared, though the majority were too thick and whitish coloured, instead of being colourless and transparent; Mr. Rogers's specimens he compared to the Cake Brazilian.

Chemical
properties.

Mr. McClelland, in sending this Isinglass, writes, that in Calcutta it was found to correspond precisely with the Russian Isinglass in

Chemical and Essential properties. The author sent specimens to Mr. Hennel of Apothecaries' Hall, which he was good enough to examine. He complains of it as being insoluble, very closely resembling the Brazilian Isinglass, and therefore of low value. As the article promises to be of considerable importance as an export from India, it was desirable to have it submitted to a detailed and careful Chemical analysis. Mr. Edward Solly, jun., Lecturer on Chemistry at the Royal Institution, has furnished the following account of the results of his experiments.

Bengal
Isinglass,
Chemical
characters.

NOTE ON BENGAL ISINGLASS.

Good Isinglass is generally described as being one of the purest forms of Gelatine we are acquainted with; it consists, in fact, of little else besides, and accordingly presents very nearly the characters of that substance. The properties of pure Isinglass or Gelatine are briefly the following. It is transparent and colourless, or nearly so, inodorous, tasteless, and of a hard or horny consistence. It is but little hygrometric, remaining tolerably dry in ordinary conditions of the atmosphere. In cold water, it gradually softens and swells up; in hot water, it easily dissolves, and forms a clear solution, which if it contain as much as a $\frac{1}{100}$ th part of its weight of Gelatine, has the property of gelatinizing or assuming the form of a soft tremulous solid as it cools. Dry Gelatine is permanent and unchangeable substance, but in solution it is very liable to undergo decomposition, becoming

Bengal
Isinglass,
chemical
characters.

mouldy and rapidly putrifying when exposed to the air; it has been observed that the ordinary and more impure forms of Gelatine are more liable to undergo these changes than the pure substance, the presence of minute quantities of acids, alkalies, and other impurities, greatly accelerating its decomposition. All Isinglass contains small quantities of Albumen, saline and earthy matter, and a peculiar substance called Ozmazome, the better sorts containing less, and the inferior more of these impurities.

The Bengal Isinglass consists of Gelatine, Albumen, a small portion of saline and earthy substances, Ozmazome, and a minute trace of an odorous oil. The Albumen exists in an unusually large proportion, which of course somewhat modifies the properties of the Isinglass. The pieces are rather unequal in composition, some of the thinner portions being purer and containing less Albumen than the others, thus three experiments gave the following results :—

ISINGLASS.	SOLUBLE GELATINE.	INSOLUBLE ALBUMEN.
1,000 parts	865	135
Ditto	909	91
Ditto	928	72

The best pieces have comparatively little colour or smell, dissolve tolerably easily in water, and form a good firm jelly, which appears to have but little tendency to become mouldy. The inferior pieces are somewhat coloured, unequal in appearance, dissolve with difficulty, and have a peculiar disagreeable smell, in great part due to the presence of the oily substance before-mentioned. From the appearance and properties of this Isinglass, it is probable that its defects are in a great

measure to be attributed to a want of sufficient care in its preparation, and it is evident that good Isinglass cannot be made without considerable attention is paid during the processes of washing, beating, scraping, and drying; all of which have a very important influence on the goodness of the finished Isinglass. Some of the samples of the Bengal Isinglass are unquestionably very good Isinglass, whilst others are decidedly inferior, in consequence of their being but imperfectly soluble in water, and possessed of a peculiar and disagreeable smell; it, therefore, becomes important to inquire into the cause of these objections, and the best way of obviating or removing them. The imperfect solubility of some, and more especially the thick pieces, is occasioned by the presence of a considerable quantity of Albumen or insoluble membranous matter, having most of the properties of Albumen, which is not only itself insoluble, but in addition renders much of the Gelatine, with which it is associated, likewise insoluble. It is more than probable that the greater part of this albuminous substance might be readily removed by sufficiently scraping the Isinglass during its preparation. Attention should also be directed to the process of drying, as, if not properly dried, it might possibly undergo a slight change or decomposition, and become partially converted into a more insoluble form of Gelatine. A more important objection is the smell, which, however, may likewise to some extent be traced to the preparation. When the inferior pieces of this Isinglass are boiled in water, the surface of the fluid soon becomes covered with a very thin film of oily matter, and the disagreeable fishy odour is then very strong; when, however, the boiling or simmering has continued for some little time, the surface becomes clearer, and the

Bengal
Isinglass,
chemical
characters.

Bengal
Isinglass,
chemical
characters
of.

odour gradually diminishes ; so that by boiling for some time, good and strong jellies may be easily made, having little, if any, more smell than those made with ordinary Russian Isinglass. Great care should be taken that the Isinglass is as little as possible contaminated with the animal fluids of the fish, because when this is the case it is very difficult completely to purify it by subsequent washing, and a little attention to such points as these would greatly improve the value of the produce. It would be easy to suggest plans for the removal of the bad odour of the Isinglass, but it would be far better if it can possibly be prevented by increased care in the preparation and curing.

E. SOLLY, Jun.,

Lecturer on Chemistry at the Royal Institution.

Improve-
ment of.

From the foregoing analysis and observations, it is evident that the Bengal, possesses all the essential qualities of good Isinglass ; and that with a little more care and some modification in the process of preparation, it is probable that the smell might be got rid of, as well as a considerable portion of the albuminous parts. How these very desirable objects, may be best carried into effect, will appear when we can compare the mode of preparing Isinglass in India with that which has been so long and so successfully practised in Russia.

Mr. McClelland, in the manuscript which accompanied his specimens, states that, " The Sounds when received fresh are opened and

stripped of the vascular covering and internal membrane, washed, and at once made up into any form the manufacturer finds most convenient for packing. The article requires no further preparation than this :—

Bengal
Isinglass,
preparation
of.

“ When dry, before it reaches the manufacturer (which is commonly the case, the fish being caught at a distance, towards the sea), the sound is to be opened, and as much of the lining membrane removed as possible by the hand. A large earthen vessel is then filled with sounds, and water poured into it, and the whole covered up for twelve hours, when the sounds will have been brought back to their original soft state, in which they may be perfectly cleaned, as if they had been obtained fresh.

“ For the removal of discoloured parts, as well as for perfectly softening the more solid portions of the Sounds without dissolving the thinner parts, they are steeped a short time in alum water, that is, an ounce of alum in four or five gallons of water. When saturated, each Sound is to be taken out and spread on a linen or cotton cloth, also saturated with alum water, and then rolled tight up and set aside for twelve hours, and this process is to be repeated until the Sound is perfectly bleached, when it may be either drawn out between the fingers into shreds in the direction of the fibre, or

Bengal
Isinglass,
preparation
of.

rolled into thin plates. When the quantity in hand is large, a little chalk is sprinkled over the soft substance after it has been rolled. This adheres as long as the Isinglass is soft, but may be dusted or rubbed off when it dries. There is, however, no harm in allowing it to remain on the surface, as in case of exposure to damp during the voyage, it may act as a preservative, and it can always be easily rubbed off before use."

Prepara-
tion of
Isinglass in
Russia.

If we wish to compare this, with the method of preparing Isinglass on the shores of the Caspian, we shall find that it is difficult to get any account, which is sufficiently minute for a manufacturer to take as a guide, in all the details of the operation. Most of the accounts published, however, are by scientific travellers, and therefore, worthy of attention, but the preparation of Isinglass is only one of the numerous subjects which they describe.

Account by
Mr. Jack-
son in 1783.

The earliest account pretending to any accuracy is that of H. Jackson, published in 1783, in the 63rd vol. of the Philosophical Transactions, who says he made an unsuccessful voyage to Russia to learn the mode of making Isinglass. But he afterwards succeeded in getting the necessary information. His object was to find a good substitute for brewers in fining their beer. For this purpose, he first

ascertained experimentally that Isinglass, or the natural membrane of the Sounds of Fish, is much more efficacious than any solution of glue, that is of Gelatine as it would now be called. He describes the Sound as taken from the fish while sweet and fresh, slit open, washed from the slimy sordes, divested of every thin membrane which envelopes the Sound, and then exposed to stiffen in the air. He also details the mode of making, and gives figures of the long and short staple, and of the book form of Isinglass. •

Preparations of Isinglass.

The Sounds of the Cod and Ling, he states, bear great analogy to those of the Sturgeons; and that they had been prepared and employed as substitutes for the foreign Isinglass in fining, and with similar effects, except in warm weather. The only peculiarity, he describes in their preparation is, that when the Sounds are slit open, they are washed in lime water, in order to absorb their oily principles; and then in clean water, when they are laid upon nets to dry. He also states, that since this discovery, and before the publication of his paper, forty tons of British Isinglass had been employed; also that several specimens of fine Isinglass had been obtained from North America, in consequence of advertisements distributed in different parts, offering premiums for the Sounds of Sturgeon and other

From the Cod and Sound.

Isinglass,
preparation
of in Rus-
sia.

fish. In this we may probably trace the origin of the American trade in Isinglass.

The several distinguished naturalists who were employed by the Russian Government in exploring the different parts of that extensive empire, have collected valuable information on this, ■■ on many other subjects. This we find incorporated in several works, as in Tooke's View of Russia, published in 1799, and in the recent one of Brandt and Ratzeburg (v. p. 17).

Three coats
of swim-
ming-blad-
der.

Brandt and Ratzeburg describe the swimming-bladder as consisting of three membranes, the outer or peritoneal coat, the middle membranous and muscular one, and the inner glossy highly vascular coat, which has a pulpy appearance, and is the membrane which forms the best Isinglass. The species which yield it are the Great Sturgeon, Osseter, Sevruga, and Sterlet, also the *Silurus Glanis*, Barbel, *Cyprinus Brama* and *Carpio* and *Percu lucioperca*, which do not belong to the tribe of Sturgeons.

Russian
preparation
of Isinglass.

In the fisheries of the Caspian and Volga, where the system is most complete and the division of labour the greatest, the Sounds and Roes are extracted immediately the fish are caught, and delivered over to the Isinglass and to the Caviare makers. The fresh Sounds are first split open and well washed, to separate the blood and any adhering extraneous matter

(on the Lake Baikal, warm water is used, according to Georgi) ; they are then spread out, and exposed to the air to dry, with the inner silvery white membrane turned upwards. This, which is nearly pure Gelatine, is carefully stript off, laid in damp cloths (or left in the outer covering), and forcibly kneaded with the hands. It is then taken out of the cloths, dried in the form of Leaf Isinglass, or rolled up, and drawn in a serpentine manner into the form of a heart, horse-shoe, or lyre (long and short Staple), between three pegs, on a board covered with them; here they are fixed in their places by wooden skewers. When they are somewhat dried thus, they are hung on lines in the shade till their moisture is entirely dissipated. The oblong pieces are sometimes folded in the form of Book Isinglass. In order to obtain good Isinglass, it is necessary to have well-arranged rooms to dry it in, as at Astrakhan.

Isinglass,
mode of
preparing
in Russia.

It has been questioned by some authors whether any Isinglass is prepared with the aid of heat or of solution, but such will come rather under the head of Gelatine, or of Fish-glue, than of Isinglass. There is no doubt, according to Pallas even, that at the lower parts of the Volga, a fine Gelatine is boiled out of the fresh Swimming-bladder, and then poured into all kinds of forms. In Gurief, a fine boiled

Whether
any pre-
pared by
boiling or
solution.

Fish-glue
obtained by
boiling
parts of
Fish.

Fish-glue is prepared, perfectly transparent, having the colour of amber, which is cast into slabs and plates. The Ostiaks also boil their Fish-glue in a kettle. The Common Cake Isinglass is formed of the fragments of the other sorts: these are put into a flat metallic pan, with a very little water, and heated just enough to make the parts cohere like a pancake, when it is dried. Parts of the Sounds of *Silurus Glanis* and *Barbel* are also boiled; but, as the glue does not entirely dissolve, the liquid is strained, to separate the filaments from the Gelatine. Besides these, the cartilaginous and tendinous parts of several fishes are boiled down to form Fish-glue.

Compara-
tive good-
ness of
Isinglass.

The Osseter yields the best kind of Isinglass; that of the Beluga is the worst obtained from the tribe of Sturgeons, but this is said to be improved by the addition of that of the Sev-ruga and Sterlet. The Glue of the last is the most tenacious, and is valued for inlaid cabinet work. Russian authors state that Isinglass is sometimes adulterated by the intermixture of pieces of common bladder and of the intestines of animals.

Compara-
son of Rus-
sian and
Indian me-
thods.

In comparing the Russian and Indian processes, we observe a general resemblance, though the differences are considerable enough to modify some of the results. In the first place,

the Russian manufacture, being more extensive, has men especially devoted to the preparation of the Isinglass, while others prepare the Caviare, or salt the fish. The inner membrane also of the Sturgeon yields the best Isinglass, while in the Sele it seems to be rejected. This would account for the more fibrous nature of the Bengal Isinglass, though it does not follow, that in the Sele, the innermost is the best. A decided improvement would be effected if the Isinglass were prepared as soon as possible after the fish is caught. The Sounds should be extracted, split, and more carefully washed (perhaps with lime-water) than the native fishermen are likely to practise if left to themselves, besides being freely exposed to the air.

The lightest kind of roof at the nearest point, as at Sangor Island, would probably enable the Sounds to be better dried than when exposed to a powerful sun, as in the latter case the oily parts may melt and be more extensively diffused through the membranous structure, than would be the case in drying in the shade. Part of the oiliness and smell may probably be removed by chemical reagents, as lime and chlorine, but their use (unless very careful) is likely to leave a taint, which would be objected to by purchasers. Thus some Isinglass has been employed for

Suggestions for improving Bengal Isinglass.

Cleaning, drying, &c

Construction of covered buildings.

Action of chemical reagents.

Sug-
gestions for
improving
Bengal
Isinglass.

Separation
of albumi-
nous parts.

Applien-
tion of pres-
sure.

Boiling
and solu-
tion.

glazing calicoes, and an attempt was made to substitute glue, but it was found that the impurities which the Glue contained changed the colours of the printed calicoes.

The Indian Isinglass as at present prepared, is complained of as too thick, if intended to come into competition with the superior varieties of Russian Isinglass. Some of it may, without difficulty, be rendered thinner, for even in the dried state, layers of membrane which display a fibrous structure may be stripped off, and which no doubt contain the greater portion of the insoluble Albumen. It might also be made thinner by beating, or pressing between iron rollers or marble slabs, ■ is done with American and some kinds of Brazilian Isinglass. The extra labour which this would require might be profitably saved, by not tearing it into fibres, in which state it is disapproved of in the market; but it might still be cut or rasped into a state fit for domestic use. The refuse should be turned to account | the soluble parts of the Sounds separated from the insoluble, and poured out into thin plates and dried on nets, as is done with some of the Gelatine of commerce.

By these means, or by others which will no doubt suggest themselves, when the objections to the Indian Isinglass are known, the manu-

facturers will be able to improve it to the degree requisite to enable it to occupy a permanent, as well as a high place among the Isinglass imported into the principal markets of Europe. Though the first quantities sent from India brought only 1s. 7d., others have been sold for 3s., and a few samples have been valued at 4s. per pound. Besides this opening for an extensive sale in the European market, even in the present state we know there is always a constant demand in China for the Isinglass of Bengal. This will no doubt afford sufficient encouragement to persevere in the extension and improvement of this newly established and highly promising article of the export trade of India to Europe.

Probable
improvement of
Bengal
Isinglass.

Seeing that so large a quantity as 800 or 900 maunds, of the Sounds of Fish, that is of Isinglass, is exported from the neighbourhood of Calcutta, it is certainly remarkable that it should never have attracted the attention of any one, even as an object of curiosity. Still more so that it should have escaped the notice of mercantile men, as doubtless a knowledge of the fact might have been turned to profitable account. But now that it is known, those who are interested in the improvement of the Resources of India, will not feel satisfied with seeing a lucrative trade confined to one

Can Isinglass be obtained from other parts of India?

Is Isinglass obtainable from other parts of India,

place, when there is every probability that it might be profitably practised at many points of the long extended coasts of the British Empire in India.

It becomes desirable, therefore, to ascertain the points where the fishes yielding Isinglass in the Hoogly and the Sunderbuns resort to in shoals, if at the mouths of the Irrawady and Burrampooter, or at those of the Mahanuddy, Godavery, and Cauvery, or in the Gulfs of Cambay and Cutch, or at the mouths of the Indus. Also, whether there are not, in these situations, other fishes of which the Swimming-bladders are at least as easily convertible into Isinglass. At the same time we should inquire whether Isinglass or any similar substance is at present exported, by the Chinese or others, from these situations.

or any similar substance exported to China?

Pong-tong, a Chinese name for gelatinous substance.

The fondness of the Chinese for all gelatinous substances is well known, and has been described by all those who have visited their country and partaken of their banquets. In addition to employing animals and parts of animals which are rejected in other countries, as articles of diet, they import various substances which can be valuable only as yielding Gelatine of different degrees of purity; of these we have examples in Agar-Agar, Tripang, Birds'-nests, Shark's-fins, and Fish-maws.

The Agar-Agar is a species of *Fucus* or Sea-weed, exported from the islands of the Indian Archipelago, as a portion of the cargo of every junk. It forms a gelatinous mass with water, to which the Chinese add sugar; and use it as a sweetmeat. Another Sea-weed (*Gracillaria tenax*) is imported in large quantities into Canton from the coasts of Fo-kein and Tche-kiang, and is supposed to be an ingredient of the Chin-chou glue or jelly. Another species, ■ native of Ceylon (*Gracillaria lichenoides*) is also of a gelatinous nature; and after being washed in fresh water and pressed to remove the salt and some mucilage, is employed as a preserve. This is thought to be the substance, which by some is considered to be a species of *Gelidium*, and by others the spawn of fish floating on the surface of the sea, made use of by the Salangana, or Esculent Swallows, in constructing their nests, which are so highly esteemed by the Chinese. That appears, however, to be a viscous secretion of the salivary glands of the mouth and stomach of the bird, like what is observed hanging from the bill of the common Swallow. The nests, Mr. Crawford remarks, both in external appearance and consistence, resemble a fibrous ill-cooked Isinglass. At all events, the best kinds are sold for about £5. 18s. ½d. per pound, and even as high as 4,200 Spanish Dollars

Agar-Agar.

Gelatinous substances exported to China.

Sea-weeds.

Edible Birds' nests.

Gelatinous
substances
imported
into China.

per picul; these last, therefore, are more valuable than their weight in silver. Mr. Crawford calculates that not less than 242,400 lbs. of different qualities (white, middling, and black) are yearly imported from the Indian Islands into China.

From Is-
lands of
Indian Ar-
chipelago.

Mr. Crawford, after stating that the Fisheries of the Indian Islands form a most valuable branch of their commerce, and that a great variety of the fish caught, are dried in the sun, proceeds to observe that "ordinary dried fish forms no portion of the foreign exports of the Indian Islands, but three singular modifications of it do, *Fish-maws*, *Shark-fins*, and *Tripang*, all of which are sent to China in large quantity."

Tripang.

The Tripang Swala, or Beche de Mar, often called Sea Slug, one of the tribe of *Holothuriæ*, is an unseemly-looking molluscous animal, which constitutes, in quantity and value, one of the most considerable articles of the exports of the Indian Islands to China. There are fisheries of Tripang in every island of the Indian Archipelago, from Sumatra to New Guinea, and upwards of not less than 8,000 cwt. are yearly sent to China from Macassar. The price ranging from 8 Spanish Dollars per picul to 20, and as high as 115, according to the quality.

Shark-fins.

The same author states, that Shark-fins are exported to China from every maritime country, between the Arabian Gulf and the East Indian

Islands. A picul of Shark-fins usually sells in China as high as 32 Spanish Dollars, or at £6. 1s. per cwt., which high price makes it evident, that they are only articles of luxury for the use of the rich. In the market of Macassar, the ordinary price is about 15 Spanish Dollars, or £2. 16s. 8½d. per cwt.

Shark-fins,
value of.

Of the three substances mentioned by Mr. Crawford as exported from the Indian Islands, one only remains to be noticed, and this is *Fish-maws*. But of this he merely says, that it “is a favourite article of the strange luxury of the inhabitants of that country, often bringing as high as 75 Spanish Dollars per picul, or £14. 3s. 6d. per cwt., in the market of Canton.” Neither in his nor in any of the other works which the author has had an opportunity of consulting, has he been able to find any description of fish-maws. The name had frequently struck him, when endeavouring to ascertain the countries which actually produced different drugs, by tracing their names from one price-current into another. Being unacquainted with this substance and unable to procure information respecting its nature, he placed it in a list of subjects for inquiry.

Fish-
maws.

Exported
to China

Nature of
not stated.

In the course of the present researches respecting the production of Isinglass in India, the subject recurred to his mind; he then again

Fish-
maws

referred to the price-currents, and finding that fish-maws were imported into Canton and exported from Bombay, he was induced to consult the official accounts of the exports and imports from the three Indian Presidencies; and was surprised, as, no doubt, others will be, to find, that not less, than to the value of nearly forty thousand pounds of Shark-fins and Fish-maws was exported in one year from Bombay to China, being first imported from the great variety of places mentioned below, and sold at the following prices:—

Prices of.	The price of Fish-maws was from 90 to 105 rs. per maund in 1836-37					
	Ditto	ditto	ditto	92.8 to 95	ditto	in 1837-38
	Ditto	Shark-fins	ditto	18 to 25	ditto	in 1836-37
	Ditto	ditto	ditto	35	ditto	in 1837-38

QUANTITIES AND VALUE OF SHARK-FIN AND FISH-MAWS IMPORTED INTO AND EXPORTED FROM BOMBAY IN THE YEARS

Shark-fins
and Fish-
maws.Imported
into Bom-
bay.Exported
to China.

<i>Shark-fins and Fish-maws.</i>	1836—37.			1837—38.		
	Cwt.	lbs.	Value, Rs.	Cwt.	lbs.	Value, Rs.
From the Coasts of—						
Africa.....	38	0	1,300	87	66	2,700
Ceylon	5	52	225			
Arabian Gulf.....	915	72	32,775	461	81	14,815
Persian Gulf.....	1,849	0	69,080	2,456	70	80,721
Malabar and Canara...	417	101	10,874	617	66	14,359
Cutch and Scinde	742	91	31,916	0	133½	512
Goa, Demann, and Diu	203	70	15,748	68	63	4,981
Subordinate Ports—						
Panwell and Concan...	101	93	6,330	183	6	3,726
Guzerat	15	90	580	108	49	4,437
Imports into Bombay ...	4,172	50	1,64,931	4,346	103	1,40,520
Exports to China	9,426	28	3,92,676	5,088	39	2,55,115

Besides these there were imported into Madras :—

Shark-fins, and Fish-maws.	1837—38.			
	Cwt.	Lbs.	Value. Rs.	
Imports—Fort St. George				Imported into Madras.
From Ceylon and Tranquebar	64	0	252	
* From Ganjam, Vizagapatam, Rajahmundry, and along the Coast	105	0	3,814	
Exports—				Exported from Madras.
To China and Straits of Malacca	1,043	0	22,880	
From Tanjore to Straits of Malacca ...	39	0	11,527	

From the quantities of Fish-maws, which, the author thus unexpectedly discovered, were exported, and the high price which was paid for them, that is from 2s. 1½d. to 2s. 6¾d. a pound, he concluded that the substance must be well known; or if not the fish, at least the part of the fish which was so called. But on inquiring of several gentlemen well acquainted with the products and commerce of Bombay, he was unable to obtain any more precise information than he had already procured. He then applied to Mr. Malcolmson, of the respected firm of Forbes and Co., to obtain for him the requisite information, and, if possible, a sight of a specimen, if there should be any in London. Mr. Malcolmson was good enough to send him some specimens of different sizes, of the Bombay

* Fish-maws from Rajahmundry, Tanjore, Tinnivelly, and Malabar.

Fish-
maws.

Fish-maws. On examination, these proved to be composed of ■ sac-like membrane, which had been slit open ; some were small, thin, and transparent, others three and four inches across in both diameters, something of the shape of short purses with spring clasps, of a light colour, and semi-transparent ;—resembling the ordinary qualities of Isinglass, especially some of the Brazilian kinds, in appearance. On submitting these to Mr. Yarrell, he pronounced both kinds to be the Sound of a Fish which he thought might perhaps be the same species, but at different ages, and that it was apparently allied to the Gurnards. It is interesting to observe, Cuvier mentions that there are species allied to *Trigla hirundo* (or the Sapphirine Gurnard) in India.

Are Fish
Sounds,

Thus we see that Fish-maws are Fish Sounds ; and as Fish Sounds were carried away by the Chinese from the vicinity of Calcutta, at the rate of about a shilling a pound, without any one being apparently aware of it ; so in Bombay a commerce has long been established in Fish-maws, at about double the price of the former, without its being generally known that it was Isinglass which was thus exported. The Chinese, therefore, obtain from India, what we import from Russia and Brazil, and in this respect exhibit no greater strangeness of taste than we do ourselves. For they give only about

therefore,
Isinglass?

the same price (£14) which is obtained in the London Market for Isinglass of the same quality; while we give as much as between £60 and £70 for the best kind and between £90 and £100 when we require this for consumption.

The large quantities in which these Fish-maws are collected and exported from the Port of Bombay (independent of what Mr. Crawford mentions as exported from the Indian Islands to China), indicate that very large numbers of Fish must have been caught; in fact, that the natives of these various countries must be in the habit of paying very considerable attention to Fishing in general.

We are thus almost insensibly led from a consideration of the mode of preparing the Scales of Fish, to that of the methods of procuring and preserving the Fish themselves; also to the amount to which these processes are practised, or to which they may be extended.

Consideration of methods of procuring Fish.

The most cursory inspection of the preceding table of the imports into one port, shows that Fishing must be followed to a considerable extent on the African Coast, and the Gulfs of Arabia and Persia. The Arabs have indeed, from the earliest times, been noted as navigators, and for having been the carriers of the produce of India to the shores of the Red Sea and the Banks of the Euphrates, which

Fishing long followed.

Fish-
mays. ol,
el men.

thence found their way into Egypt, Syria, and Europe. The Natives of India are generally supposed to be little addicted to the sea, or to availing themselves of the treasures which it affords; but the foregoing table shews that the Gulfs of Cutch and Cambay, as well as the Malabar and Coromandel Coasts, all send the spoils of the sea to be exchanged for the treasures of the land. We know also that Fishing is practised to a considerable extent in the vicinity of Bombay, Madras, and Calcutta, as well as everywhere in the rivers, in the interior of India. It may be thought that this change has taken place in modern times, but if this were so, it is curious that Menu (who is said to have flourished 800 or 900 years before the Christian æra) should in his Institutes have made an exception in favour of adventures at sea, when limiting the legal interest of money, and that Fa-hian, in the fifth century, made a voyage from Ceylon and Java to China in a vessel belonging to Brahmins.

At the time
of Menu.

In the pre-
sent day.

In the present day, Sir A. Burnes represents “the mariner of Cutch as truly adventurous,” putting to sea for a trifling reward, and stretching boldly across the ocean to Arabia, the Red Sea, and the Coast of Zanguebar in Africa. The sea vessels of Curachee sail to Muscat, Bombay, and the Malabar Coast; and

the fishing-boats at the mouths of the Indus India.
 he describes as good sea-boats, sailing very
 quickly, and as numerous, because the fisheries
 there are extensive, and form a source of com-
 merce. So Dr. Cantor states, that at the Fishermen
of.
 mouths of the Ganges, the Fishermen have sea-
 going boats, which they build themselves; and
 that they are a superior description of Indian
 Sailors, of much more industrious habits than
 the majority of the natives of India. If we
 look still further to the eastward, we shall see
 the Burmese and Siamese almost living in
 boats, and the Malays most formidable as
 Pirates in the Indian Seas. Mr. Crawford re- Indian Ar-
chipelago.
 presents the Indian Islanders as expert fisher-
 men, and that there is no art which they
 carry to such perfection as fishing, which the
 nature of their climate allows them to practise,
 with hardly any interruption, from one end of
 the year to the other: the fishing-boats pro-
 ceeding to sea with the land-breeze at an early
 hour of the morning, and returning with the sea-
 breeze a little after noon. The fisheries afford Fisheries
of.
 a most valuable branch of their commerce, as
 a great variety of their fish are dried in the sun,
 or salted and dried, and sent by the inhabitants
 of the Coast in large quantities into the interior
 of their islands, or transmitted to every part of
 the Archipelago. ■

Indian
Fishery

to be ex-
tended

Present
practice of.

Seeing that the inhabitants of the Coasts of these various countries already practise fishing to some extent, it is desirable to inquire whether this may not be still further extended. Dr. Cantor has particularly called attention to the importance of attending to, and encouraging the sea fishery, in a paper which the author had the honour of presenting to the Royal Asiatic Society, and which is published in their Journal. Sea fishing, Dr. C. states, is carried on to a very small extent, chiefly because the distance to Calcutta is too great to allow of the carriage of fish in a fresh state. The only class of fishermen who have sea-built boats inhabit villages situated near the entrance of the Hoogly. Their chief and most profitable employment consists in attending, with their boats, on the shipping entering and leaving the river, for which they receive 16 rupees per diem. Whenever this employment fails, they resort to work with their nets, which they drag during high water along the coasts of the Sunderbuns. Two or three times are, generally speaking, sufficient to load a boat with fishes and shell-fish (a truly prodigious quantity being brought up in a few hauls). The larger portion of the prize which is not consumed or otherwise disposed of on the spot, is then preserved. This process consists simply

in dividing the fish, taking out the viscera, and spreading them in the sun till they become sufficiently dried.

“ With a view to ascertain how far the locality and climate would favour the process of salting and drying fishes on the coasts of Bengal, Captain R. Lloyd (who, as Marine Surveyor General, has always evinced a strong desire to inquire into the natural products and resources of those localities which by his indefatigable zeal have been surveyed), caused a series of experiments to that effect to be tried on board. The materials submitted to trial were either purchased from fishermen at the rate of three rupees ■ hundred, or supplied by the nets belonging to the fishing-boats attached to the survey. The experiments turned out so satisfactorily, that I feel convinced that the process of curing, salting, and drying fishes, may easily be accomplished there during the north-east monsoon, that is, during the period from 15th October, to the 15th of April.” (*Cantor, l. c.*)

Preservation of fish on the Coasts of Bengal.

Dr. Cantor did not fail to take advantage of the opportunities which others neglect, and made himself acquainted with the natural history of the part where he was placed. Thus, while discharging the medical duties on board the Honourable Company's surveying vessels

Fishes of the Bay of Bengal.

Indian
fishery.

at the Sandheads, he examined the Fishes of the northern part of the Bay of Bengal, and those of the Gangetic estuaries. He observes, that by reference to the ichthyological works of Dr. Russell, Dr. Buchanan, Baron Cuvier, and Mr. Bennet, describing the Fishes from different Indian localities, he found that at least one-third, perhaps one-half, out of upwards of a hundred species, which he examined between Calcutta and the 21° of N. latitude, were not noticed by the above authors. The fact is, as he states, he observed many species, inhabiting a more southern latitude, which were brought up towards the mouths of the Ganges, by the strong flood-tides prevailing during full moon, while others only temporarily enter the rivers during the spawning season.

Importa-
tions of
from Bur-
ma.

The *Polynemus Salliah*, or *Saccolih*, has already been mentioned as entering the mouth of the Ganges in shoals. The Kharrah, or Indian Mackerel, a species of *Thynnus*, is rather uncommon in these estuaries, but it must be found in abundance on the Burmese coast, as from thence, great numbers, in a dried state, are annually imported into Bengal. The Cartilaginous fishes, Dr. C. states, abound in numbers and species, and are remarkable for their wide geographical distribution. The Sharks enter the rivers to a

considerable distance from the sea. Shark-skin, he says, is used by the native workmen for polishing wood and ivory; and Shark-fins we have seen are largely exported to China.

Indian
Fishery.

Of the better known salt-water fishes of a wider geographical distribution, such, for instance, as are valued as articles of food, at the three distant points, Calcutta, Madras, and Bombay, the market of the first is the least rich in varieties, in consequence of its greater distance from the sea. The abundance of the supply, however, makes up for what it wants in variety; and the great demand for fish affords a livelihood to great numbers of fishermen, who every night spread their nets in the river, and in the salt-water lake.

Edible
Fishes.

The *Lates nobilis*, different species of *Polynemus*, and the *Mugil Corsula* daily cover the tables of Europeans, who will more readily recognise these fishes under the names of the Begti or Cockup, Sudjeh, Tupsi (Mango fish), and the Indian Mullet. At the Sandheads, may be found some of those delicious fishes, which are more familiar to the residents of Madras and Bombay; for instance, the Indian Soles, the Roll-fish, and, above all, the Black and White Pomfrets, and the Bummoloh, which latter, in a dried state, is known by the name of the Bombay duck. Of these, the Indian

At Calcutta.

At the
Sandheads.

Indian
Fishery.

Mullet is the most widely distributed, being common in the Straits of Malacca, the Bay of Bengal, the Persian Gulf, and the Red Sea, also at the Cape of Good Hope.

Dried Fish
in Calcutta
bazar.

“The bazars in Calcutta,” Dr. Cantor remarks, “are always stocked with an ample supply of dry fish, which is consumed partly by the European and native shipping of that port, partly by the poorer classes of Bengal, and the Upper Provinces. Cargoes of this article are annually imported by the Burmese and the Arabs.”

Quantities
not ascer-
tained, as
no duty is
levied.

But as no duty is levied on the importation, Dr. C. had been unable to ascertain the actual amount, which, however, from the information he obtained from European and native merchants, he had no doubt was considerable. By examination, he found these dried fishes to consist chiefly of the Bummalos, the above-named Siluroid Fish, which sells in Calcutta at the rate of four or five rupees a hundred, the Indian Mullet, the Sudjeh, the Begti, and the Kharrah or Indian Mackerel.

Species of
dried Fish.

The demand for dried fish exists all along the coasts of the Peninsula, as the author, by examining the official accounts of the commerce of the different districts of the Presidency of Fort St. George, finds that dried and salted Fish are imported from Bengal, Pondi-

cherry, Ceylon, Travancore, Goa, Bombay, and Arabia, also sometimes from the Maldives into Ganjam, Madras, Tanjore, Tinnivelly, and Canara, as will appear from the following table. Of the quantity imported, a small portion, to the value of 1,009 rupees, was taken into Mysore, and to the value of 1,087 rupees exported to the Straits of Malacca.

Demand
for dried
Fish along
the Coasts
of India.

<i>Salted and dried Fish, imported into.</i>	<i>Rupees.</i>	<i>From.</i>
Ganjam to value of	5,377	Pondicherry, Bombay, Arabia, Ceylon, and Travancore.
Madras ditto	7,921	
Tanjore ditto	1,181	
Tinnivelly ditto	3,512	Travancore and Malabar, by sea.
Ditto ditto	69,590	Travancore, by land.
Canara ditto	6,037	Bombay, Arabia, and Pondicherry, by sea.
Ditto ditto	3,025	
		Goa, by land.

That considerable attention must be paid to fishing all along the coasts is evident, from these facts as well as from those adduced respecting Fish-maws and Shark-fins. At Bombay the large quantities of the Bummalo, which are both consumed and exported, prove the same, though, from no duty being levied, we are unable to ascertain the quantities which are either caught or exported. At the mouths of the Indus, the fishery is extensive, and there, no doubt, some of the Fish Sounds are procured. This is evident from the imports into Bombay, and from Lieutenant Carloss stating, that Cod

Fishing on
Coasts of
India.

Indian
Fishery.

Sounds and Shark-fins are exported from Carachee. The former are, no doubt, Fish-maws, perhaps Sounds of Polynemi, as Mr. McClelland suggests, but they may also be those of other fish; as the specimens of Fish-maws given to the author by Mr. Malcolmson, are very different in form from the Isinglass sent from Bengal.

Increasing
supply of
fish in in-
terior of
India.

Mr. McClelland, in his paper, calls attention to the very important subject of increasing the supply of fish in the interior of India. Wherever there are any large pieces of water for the purposes of irrigation, as in the Peninsula of India, these he conceives might support quantities of fish, if proper kinds were selected, and pains taken to destroy the injurious animals, in the season when the water is sufficiently low for the purpose. He also suggests that at the different sanitarium which have been established in the mountains, it would be desirable and easily practicable to form rivaria, which would at all times yield a supply of fish. This might, ■ he suggests, be done by damming up a portion of some of the valleys through which the mountain streams pass.

Curing of
Fish.

He also further recommends that the natives of India should turn their attention to the curing of fish in districts where they are abundant, and sending them to others where they

are less so, and for consumption at seasons when fresh fish becomes scarce. "The cold season, from November to February, when most fishes are taken, is short. The fishermen not having the means of curing their fish, have nothing to stimulate them to any exertion, beyond what can be consumed when fresh. Had the fisherman the means of preserving the result of his labours, his chief market would commence when the fishing season ends, and his industry would then become a permanent benefit to himself and the country at large."*

Curing of
Fish for the
interior of
India.

* Mr. McClelland observes that it must have been long known, that the difficulty of preserving meat depends more on the state of the atmosphere in regard to electricity and moisture, than on temperature, &c. With salt and other means at hand, he conceives there would be no difficulty in curing fish in an Indian climate in the months of November and December, when the Sullen fishery could be carried on. On this subject, of very considerable interest, Mr. C. R. Robison, one of the magistrates of Calcutta, remarks: "It would be a famous thing if these enormous fish (the Sullen) could be cured, as well as their Isinglass obtained; and I cannot help thinking the measure very feasible, if the fishermen at the time of taking them and cutting them up, dipped them first into weak chloride of soda, mixed with a small quantity of impure pyroligneous acid. This would not only preserve the fish till the salt acted, but improve the flavour." The pyroligneous acid, or a solution of Creosote, would probably produce the desired effect; if Mr. R.'s hint is followed literally, the mixture would produce acetate of Soda.

Summary. HAVING thus briefly taken a general view of ■ very extensive subject, we may appropriately conclude with a recapitulation of the principal points which have been discussed, and a prospective view of the important objects to be attained by perseverance in and an extension of the course which has been commenced. Isinglass, we have seen, has long been an article of commerce from the regions where it is still produced of the best quality; and chiefly by the tribe of Sturgeons, which singularly abound in seas that without them would be destitute of peculiar objects of interest for other parts of the world.—Yet even in these seas it is obtained from other fishes.

As the demand for Russian Isinglass, like its price, increased, so the former was early met by the application of the Sounds of fish abounding on the coast of Britain, like the Cod and Ling, and also of the skins of Soles. Now the present wants are supplied from other climates, as from the coasts of North America and of Brazil, and by other tribes of Fishes, which, though yielding Isinglass of inferior quality to the Russian, is yet sufficiently good

for some of the purposes to which it is applied in the arts. Summary.

Though the cartilaginous Sturgeons are not inhabitants of the Indian Seas, yet we have seen that cartilaginous fishes abound there. These may therefore yield Isinglass. Species of *Silurus* yield it in Russia and Brazil, and likewise in India; in North America a *Labrus*, and in India a *Bola*, which belong to the tribe of *Sciænoideæ*. In Europe, it is obtained from species of *Cyprinus*, and nowhere do the Fishes of this tribe abound more than in India;* and though there, we do not find the Cod, Ling, and Hake, the Sele, Teria, and other species of *Polynemus*, swarm in shoals, and yield what is already an article of export. When attention is drawn to the subject along the coasts and rivers of India, it will probably be found that several other species do already yield Isinglass (the Fish-maws of Indian commerce), and that many more will be found to do so of equal, and even superior quality to what is now imported from Brazil.

Isinglass has hitherto been accounted a product known to, and esteemed only by Europeans, but we have seen that Fish Sounds have long been exported to China in consider-

■ See Mr. McClelland's valuable paper ■ the Indian *Cyprinidæ*, *Asiat. Research.* vol. xix. p. 217. .

Summary. able quantities from the neighbourhood of Calcutta. The islands of the Indian Archipelago have also long exported to China large quantities of substances something similar in properties to Isinglass, and among them Shark-fins and Fish-maws. But these islands, numerous ■ they are, and much as their inhabitants are addicted to Fishing, are yet unable to supply the demands of those lovers of gelatinous soups, the Chinese. For in examining the commerce of Bombay, we found that the exports to China, and to a large amount, consisted of these very same products of fishes, which had been previously imported from the opposite coast of Africa, and from the Arabian and Persian gulfs, and all along the coasts of India. ■

That this commerce should have been unknown, or rather that Isinglass should never be enumerated among the products of the Indian seas, is owing to so few taking the trouble to acquaint themselves with things, instead of with names only. For Fish-maws we have seen are the Sounds of Fish, and a good deal resemble some of those which are imported from Brazil. Instead, therefore, of this being a new export from India, it is a very old established one, long known under another name. At what time the Chinese began to

import these substances from the great Archipelago, and from the coasts of India, it is impossible for us to ascertain. It may be that this ancient people were acquainted with Isinglass at as early a period, as we have any records respecting it in Europe. Summary.

Isinglass, we have seen, is esteemed as an article of diet ; it is useful as a demulcent in medicine, and is fitted for a variety of purposes in the arts. It has also the advantage, as an article of commerce, of being in demand both in Europe and the most anciently civilized parts of Asia. Hence, whatever may be the supply from increased attention along the extended coasts of India, to securing the exhaustless spoils of the ocean, it is not likely to overstep the demand, if a little more care be given to the preparation of the article. We have seen that its principal properties are due to the pureness of its Gelatine, and as this is a substance found in other parts of the animal structure, so the general demand for Isinglass has been met in its comparative scarcity and high price, by an increased preparation of Gelatine.* This, there is reason to suppose, is

* The preparation of Gelatine in the form of glucé, from skins, &c., is well known in India, and described in the Persian works on Materia Medica under the name of *ghurree-al-jallood*, *sureshum jild*, and *suresh*.

Summary. now employed even in articles of diet, where it is thought that Isinglass, or some equally pure form of animal structure, is alone admissible. And though Gelatine has been objected to ■■ not being nutritious, it does not seem less so than other simple proximate principles, both of plants and animals, which in their aggregate, as found in nature, or as mixed by art, are known to afford a wholesome, nutritious, and palatable diet to the most highly developed classes of animals.

The Indian Isinglass, we have seen, is essentially good, and its defects such as are easily susceptible of improvement by increased attention to the preparation, so as to remove the present objections; and, in fact, some specimens being better prepared than the others, prove that there can be no difficulty in preparing them all equally well. Some of the Isinglass of commerce has the defect of a fishy smell, as well as of being in part insoluble, while other kinds are made more saleable by the assistance of pressure, and more soluble by the aid of acetic acid. The only legitimate method, however, is to prepare it from the thinner and more gelatinous, and, if possible, from the inner membrane, as in the Sturgeon. The Isinglass of commerce consists of the Sounds simply dried, and of the well-prepared inner mem-

brane. The Brazilian is composed of the former, and with it the Indian Isinglass is at present able to contend. As both are now only applicable to the purposes of fining, the object should be to prepare the Indian of such quality, that it might be applied to all the purposes of the best Isinglass, and thus be able to command the higher, if not the highest prices. Summary.

The desirableness of securing a portion of the European trade in Isinglass being evident, and the feasibility of improving the Isinglass of India having been rendered probable, it remains only to consider whether the profits are likely to remunerate the merchant, as well as to induce the fishermen to extend the supply. The Russian trade, we have seen, gives employment to great numbers of the people, and yields considerable revenue to the government. But then it may be said, that not only the high price obtained for the superior and well-manufactured Isinglass affords inducements not to be expected elsewhere, but that all the parts of the Fish, as the Flesh, the Roe, and the Sounds, are turned to account. This we have seen in our cursory view of the value of the Russian fisheries of the Sturgeons, and how it is profitable to the people, and beneficial to the country.

Summary. The advantages will prove not less considerable in pursuing the occupation of fishing in India, where population abounds and labour is cheap, if the curing of fish be combined with the preparation of the Isinglass. Though far short of what is practicable, Fishing, no doubt, occupies many of the inhabitants not only of the coasts, but of those engaged in the extensive river navigation of India, as also of most parts of Asia. This to a much greater extent than appears from any of the facts adduced, as much of the Fish caught must be everywhere consumed for food, while considerable quantities are dried, and form articles of commerce, as do Shark-fins and Fish-maws. The Sounds of many Indian Fishes, might, like Sturgeons, yield Isinglass, while Fish-glue and Fish-oil might be obtained from others.

The natives of Asia are not unacquainted with other modes of preserving fish, and even the Roe appears among their articles of Materia Medica, under the name of *Butarookh*, and Mr. Crawford informs us, that “the dried Roe, of enormous size, of a kind of Shad which frequents the great river of Siak in Sumatra, constitutes an article of commerce;” while the Balachang of the Eastern Seas, consisting of small fish with prawns and shrimps, first fermented and then dried, gives rise to a con-

siderable traffic, as no food is deemed palatable without it, and its use extends to every country from China to Bengal. In Java and Sumatra, a preparation of small fish with red rice, having the appearance of anchovies, and the colour of red cabbage, is esteemed as a delicacy. So in India, the preparation called Tamarind Fish, which is much prized as a relish, where the acid of the Tamarind is made use of for preserving fish cut in transverse slices. Summary.

But the curing of fish, and the preparation of Isinglass, if properly pursued, would form the chief inducements for the prosecution of Fishery. The demand for dried fish, we have seen, exists not only in India, but in every part of Asia, and Isinglass we know is in request both in Europe and China. It might, perhaps, become an article of consumption even in India, as it is mentioned in their systems of Materia Medica by the name of *ghurree-ul-sumale*, and *sureshum mahee*, that is Fish-glue, and is described as a good diet for patients in a decline. Mr. McClelland, in alluding to Dr. Cantor's recommendation of the curing of Fishes at the Sandheads, justly observes, "that a something was then wanting to be known, in order to give a direct inducement to the undertaking." He, therefore, regards "the discovery of the Isinglass of commerce" in one of the

Summary. larger Polynemi of India as ■ circumstance eminently calculated to direct attention to a promising and almost unlooked-for source of enterprise.”

Though the object of the foregoing observations is rather to attract attention to the advantages of Fishing in general, than to confine it to one species, yet, as the benefits of an undertaking may be more clearly illustrated by an example than by a general statement, so the Sele may be adduced, and none is better calculated for this purpose, as has already been noticed by Mr. McClelland. This combines the advantages of fineness of flavour, with wholesomeness as food; while considerable in size, it is migratory in habit, and enters the rivers in great shoals at the most favourable season, that is in the cold weather, when both Europeans and natives may expose themselves to the climate, and resort to the Sunderbuns. Having a Swimming-bladder, which is of value as an article of commerce, and flesh, which is esteemed as food in a fresh state; this would become still more valuable, if it could be properly cured. It would then be in demand not only at Calcutta, but in the interior of the country as well as along the coasts of India, and might become an export even to China.

We learn from Mr. Davis's observations, Summary. that in China, "the consumption of salted provisions is very general," and also, "in consequence of the immense quantities of both sea and river fish which are daily caught, and the rapidly putrescent nature of that species of provision, a considerable portion is cured with salt, and dried in the sun, the *haut gout* which accompanies it being rather a recommendation to the taste of the Chinese. Indeed, it is one of their most favourite, as well as universal articles of food, and they even overcame their prejudice or indifference for whatever is foreign on the occasion of salted Cod being introduced for two or three years in English ships, the somewhat decayed condition in which it reached China being said to have been any thing but a drawback. This species of cargo, besides its disagreeable nature and the injurious effect which it might have on some delicate articles of shipment, was found during the voyage to breed a peculiar insect, which, from the readiness with which it bored into the planks and timbers of a ship, was considered as dangerous, and accordingly the import was greatly discontinued."

Where Stock Fish, even in a decayed state, is an article of commerce, there can be no difficulty to prepare the *Sele*, which has been

Summary. called the Cod Fish of tropical seas, in such manner as to make it desirable to the Chinese ; and if the commerce should in future be extended to the more northern ports, the demand will necessarily be much greater than when confined to the port of Canton. Like the Sele, might also be preserved a great variety of other fishes, equally abundant and esteemed, and which would be valued in a dried or salted state. The feasibility of curing Fish has been proved by Captain Lloyd's experiments, as well as by the extended commerce of dried fish in the *Eastern Seas*.

The only difficulty appears to be, that the subject is too extensive to be comprehensively embraced by those at present engaged in the Fisheries of India. They are, besides, without capital, and unacquainted with the modes and extent in which such enterprises are carried on in other parts of the world, where the demand is increased by the cheapness of the supply, and this is made remunerating by the extent of the enterprise. But as fish in a fresh as well as in a preserved state, is in constant demand, and the markets for the latter might be very greatly increased, it seems an enterprise worthy of being undertaken by Europeans, to some of whom, as to mariners, it might afford desirable employment, and prove

at the same time an eligible investment for capital. The Sele, valuable as a fish and for its Isinglass, might be made the principal object, and attention extended by degrees to other fish. The assistance could easily be procured of sailors visiting Calcutta, who are well acquainted with the curing and packing of Fish in Europe. At all events, as Mr. McClelland has well remarked, "There are not sufficient reasons why an article that might add an exhaustless supply to the common stock of food, should be altogether lost, now that a European spirit, under the influence of a paternal government, begins to infuse itself in all things connected with the resources of India."

The advantages of prosecuting Fisheries in favourable situations are so well known, and have so often and so zealously been demonstrated by the most able advocates, that we need only advert to them now. Among these may be enumerated, the finding of employment for a portion of the people, who thus obtain food not only for themselves but for their countrymen. A revenue also is drawn from unsown fields. These are ploughed only by ships, proceeding to gather in harvests, which are not only continuous, but exhaustless. The great variety of Fishes which succeed each other at different seasons of the year insure the one,

Summary. while their incalculable numbers, incredible productiveness, rapid growth, and migratory habits, produce the other. At the same time a body of hardy and experienced seamen are nurtured for the defence of their country; and for the extension of its Commerce to the most distant parts of the globe. All these afford a series of advantages which seem too obvious ever to have required advocacy.

Incredible as it may appear, it required years of energetic representation, and the continued example of rival nations reaping the harvests of the English seas, before the people of Great Britain were induced to take advantage of the benefits, with which Nature has so liberally surrounded their coasts. But it has been said, that a less numerous population found more profitable employment, in improving agriculture, perfecting manufactures, and extending commerce. The great attention, however, now paid by the people to the various fisheries, and the encouragement which has been held out by the Government for their successful prosecution, has induced numbers of men to be employed, multitudes of fish to be caught, and the internal traffic and external commerce to be so greatly increased, as to afford striking and undeniable proofs of their value and importance to the country. At the

same time they are calculated to serve as ex-
amples to other parts of the world. ■ Summary.

In India it might, at first sight, appear that the inhabitants have sufficient occupation in eliciting the riches of their naturally productive soil, and do not require to search for the treasures, and expose themselves to the dangers of the world of waters which bound their far-winding coasts. And, certainly, if we examine the capabilities of the interior of the country, we shall find few, if any, parts of the world which possess a greater number of, or more valuable objects to reward the labours of the agriculturist. Besides the various Spices and Coffee, the oil-producing Coconut and sugar-yielding Palms, in the more southern parts, we find the rich cultivation of Rice, Indigo, and Silk in Bengal; of Opium, in Behar and Malwa; and of Cotton, in all the drier plains from 10° to 30° of N. latitude. This the great experiments now carrying on by the East-India Company, with the aid of the American planters, will prove can be grown, not only abundantly, but cheaply and of as good quality ■ in any other part of the world.

Tobacco also is produced everywhere, and requires only care to fit it for the European market. So likewise Sugar, which is obtained from various Palms, as the Wild Date and Pal-

Summary. myra, as well as from the Sugar-cane, and to an extent which cannot at present be ascertained; but of which the increase in the exports from Calcutta alone, in a few years is an indication.

For the 12 months ending 30th Sept. 1838	587,169	Mds.
Ditto ditto ditto 1839	744,558	
Ditto ditto ditto 1840	1,215,120	
Ditto ditto ditto 1841	1,502,178	

At the same time Flax is rising into a profitable culture, and Hemp will most probably soon rival it. Besides these, we have plants and trees yielding valuable oil-seeds in every part of the plains; with the magnificent Teak, and many useful timber-trees at the foot of, and along the different ranges of mountains. The Tea plant also is now promising culture, in Upper Assam, and will become so on the sides, and in the valleys even of the more northern Himalayas, as Dr. Falconer has stated that he will soon require Chinese Tea-makers for the Tea Nurseries in Kumaon. For the cultivation of these and many other plants, the Agriculturist has annually the great advantage of a double harvest, in one of which he may cultivate Rice and the grains peculiar to tropical countries, and in the other those which are characteristic of European plains.*

* These subjects are fully treated of in the Author's work

Though these various Natural and Agricultural Products undoubtedly afford employment for, and contribute to the wealth of those living in the interior, yet they are beyond the reach of a numerous, and, in many places, an active and enterprising population, inhabiting the many hundred miles of coasts (intersected by the mouths of numerous rivers) of the British Empire in India. Many of these, as we have seen, are already occupied in the pursuit of fishing, and thus obtain not only an increased supply of food for their own districts, but also export some to the more distant provinces. As the varieties of Fish are great, and many are esteemed for food,—some yielding the products which make Fishes elsewhere valuable, and the numbers of all being inexhaustible, increased attention to the Fishing now practised in India is advisable. Not so much by more men being induced at first to become fishermen, as by their employment by those who could unite, and, by directing, economise their labour, and teach them to preserve its fruits. By such means, the same number of men might greatly increase the quantity, and

“ On the Productive Resources of India;” and in the “ Illustrations of the Botany and other Branches of the Natural History of the Himalayan Mountains and of the Flora of Cashmere.”

Summary. improve the value of the produce of their labours. External commerce would thus be extended, and the traffic into the interior likewise increased. At the same time that a useful addition was made to the farinaceous diet of their countrymen, they would themselves be able to obtain some of the peculiar products of other places and distant countries. Thus, ■ in other cases, while they augmented their own wealth and comfort, they would add to the riches and the Productive Resources of their country.

Since the foregoing observations have been in type, I have learnt from my friend, R. W. Barchard, Esq., that when the Bengal Isinglass was compared with an equal quantity of Brazilian Isinglass, in a brewing establishment where the latter was used, it was found that the Bengal was nearly all dissolved in the usual menstruum (sour beer) some time before the Brazilian. The Bengal Isinglass appeared also to make a much finer and stronger jelly than the other, with the advantage of dissolving in about half the time, and without any unpleasant smell.

Boiling with fresh-made charcoal would probably have the effect of depriving inferior Isin-

glass of some of the smell and colouring matter, when required for the purposes of ■ jelly.

DIRECTIONS FOR PRESERVING THE SKINS OF FISH.

As some observers may wish to preserve the Skins of the Fish which are found to yield Isinglass or any other useful product, in order that their scientific names may be ascertained by qualified Naturalists in India, or for the purpose of sending them to Europe, I have much pleasure in subjoining the following directions for preserving the Skins of Fish, by that distinguished ichthyologist, Mr. Yarrell :—

“ Take the skin carefully off from one side of the fish, of course choosing that side which is most perfect, leaving attached to it half the head, all the tail, and all the fins, above and below, which grow upon the mesial lines. Clean off superfluous flesh from the inner surface with a knife, and absorb moisture with burnt alum in powder. Place the skin on a flat board, pin it out in form, spreading the fins, dry it rapidly, to preserve colour, and when quite dry, give the outside one coat of transparent hard varnish. Afterwards, transfer the skin to white cardboard, pasteboard, or dealboard (painted white), according to the size of the fish.

“ If the specimen is likely to be exposed to the attacks of insects, wash both sides, before putting it on the first board to dry, with ■ solution of corrosive sublimate in spirits of wine ; the proportion, about two grains to an ounce.”

WORKS ON INDIAN FISHES.

As some readers may be interested in the subject of Indian Ichthyology, it may prove of use to enumerate the works in which Fishes of the Indian seas and rivers are treated of. Most of these have been referred to in the foregoing pages, as Dr. Russell on the Fishes of the Coromandel Coast, 2 vols. folio, with plates; Dr. Hamilton Buchanan, "An Account of the Fishes found in the River Ganges and its Branches," 4to., with a volume of plates. Several of Dr. Buchanan's Fishes are figured in the late Gen. Hardwicke's Zoological Illustrations, according to Mr. McClelland, As. Res. xix. p. 221; Bennett, on the Fishes of Ceylon; Mr. McClelland, on the Indian Cyprinidæ, As. Res. xix. p. 217; Cantor, on some Fishes of the Bay of Bengal, Journ. Royal Asiatic Society; Col. Sykes, on the Fishes of the Deckan, Transactions of the Zoological Society; Fische aus Caschemir, by MM. Von Hügel and Heckel; while many of the Indian Fishes, which are known to the French, are described in the Histoire des Poissons of MM. Cuvier and Valenciennes.

COINS AND WEIGHTS.

As the weights and coins of different countries are mentioned in the foregoing pages, it may be useful to add the following notice of their respective values :—

The Russian pood is equal to 36lbs. 1oz. 11dwts., but commonly reckoned equal to 36lbs. avoirdupois. The silver rouble is worth 3s. 2½d.

The Calcutta bazar maund is equal to 82lbs. 2oz. 2·133dwts., commonly reckoned 82lbs. avoirdupois. The rupee is usually reckoned at 2s.

The Chinese picul of 100 catties is equal to 133lbs. 5oz. 5·333dwts., or 133¼lbs., and the catty equal to 1lb. 5oz. 5·333dwts., or 1½lb. The tael is usually reckoned at 6s. 8d., but its value varies; the Spanish dollar, however, is the principal coin in circulation.

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THE
BENGAL DISPENSATORY
AND
PHARMACOPŒIA.

APPENDIX.

No. 1,—*Report and Correspondence on the Manufacture of
an improved Pottery from Indian Clays.*

To G. A. BUSHBY, Esq.

Secretary to the Government.

Gen. Dept.

SIR,—I have the honor to forward a report on the inquiries and experiments on Native Clays and Pottery, which I have conducted during the past six months, and which I have much pleasure in stating have been ■■■■ successful than I expected.

Specimens are also forwarded of the Clays and articles of Ware described.

I have the honor to be, Sir,

Your most obedient servant,

W. B. O'SHAUGHNESSY, M. D.

Assistant Surgeon, Chemical Examiner.

CALCUTTA, 10th December, 1840.

REPORT ON NATIVE POTTERY.

In December 1839, a communication was received from the Medical Board by the Materia Medica Committee, forwarding a despatch from the Honorable

*From Court of Directors
to Military Department,
No. 48 of 1839.*

the Court of Directors; regarding the heavy expences of supplying the common Earthenware from Europe, and directing an attempt to be made to procure an efficient substitute in

India.

The Board in forwarding this communication expressed their desire, that the general improvement of Native Pottery should be considered the chief end in any experiments which might be undertaken.

The Committee in reply forwarded the following Memorandum, which I had drawn up for their consideration, and in which the circumstances are pointed out to be attended to at the commencement of the inquiries :—

Copy of Memorandum.

"I have the pleasure to circulate for your perusal, the annexed letter from the Medical Board, together with ■ extract from a despatch from the Honorable the Court of Directors, relative to the attempt to substitute Indian Earthenware for the European article in the department of our Medical Stores.

"We must all regard as a matter of much importance, any attempt to introduce among the natives of India, the improved and admirable processes which European science has devised for the manufacture of Earthenware of every variety. There are circumstances, it is true, in the religion and habits of the great mass of the natives, which so long as they continue Hindus, will prevent their using vessels of any but the very coarsest and cheapest kind. Still the comparative few who will certainly consume the improved article, and the demand which the spread of chemical knowledge must soon rapidly create, afford sufficient inducement to the attempt now under consideration.

"The materials for the manufacture of even the best Porcelain are stated on indisputable authority* to be abundant, and accessible in the range of low Hills between Rajmahal and Colgong. The clay of disintegrated granite, felspar, quartz, flint, soapstone, and potstone, all these Minerals are found in inexhaustible profusion. According to Dr. Buchanan's statements, the quarries are already open, and sufficiently near the Ganges, to permit the raw material to be cheaply brought to Calcutta.

"It will give ■ the utmost pleasure to superintend the very important experiment of attempting to manufacture good articles of Pottery from the materials ■ have described. A furnace should be built in some convenient situation, (perhaps considering my avocations, the College grounds may be preferred,) and a suitable (fire-brick) boiler and mixing vats erected. I cannot form an accurate estimate of the probable cost; but from my experience in building furnaces in India, I would suppose 1,500 to 2,000 rupees would cover the entire expense.

"The materials for a sufficiently conclusive experiment, including the glazing process, could not at the maximum cost more than 1,000 rupees.

"It would, however, be desirable in the first instance, that the proper authorities in Bhagulpore and Rajmahal should be directed to institute inquiries as to the exact state, site, and precise proximity to water carriage of the "Khari" quarries, and as to the rate at which the material can be conveyed to Calcutta. A sufficient quantity of good flint is available in the ballast yards of the Presidency for the purpose of experiment, while the quartz quarries of the Colgong Hills are under exploration.

"In the immediate neighbourhood of Calcutta, the potters are numerous and expert. They are willing, moreover, ■ I have learned by personal inquiry, to adopt any new and cheap process they may be taught. Three or four of these people might be employed to ■ the experiment.

"With reference to Mr. Assistant Surgeon Jeffreys' experiments, I am in possession of ■ accurate information. The great ingenuity and perseverance for which that gentleman ■ distinguished, render it very probable, that he did succeed.

* Dr. Buchanan Hamilton's *Statistics of Bihar*.

Indeed the chief difficulty in this, and all such trials, seems ■ be the general dependence thereof, on private resources at the first starting. †

“ In offering to undertake the management of the experiment in question, I beg it to be understood, that I possess no practical knowledge of the manipulations of the art. But having access to good authorities ■ the subject, and being most anxious that the attempt should succeed, I will direct and watch over it to the best of my ability, should the Government resolve on carrying the proposition into effect.”

2d December, 1839.

W. B. O'SHAUGHNESSY.

The Medical Board immediately submitted this Memorandum to Government, and ■ the 17th February 1840, again addressed the Matera Medica Committee, forwarding the orders of Government for the commencement of the experiments suggested above.

On receipt of the Board's despatch, active measures were taken to obtain specimens of clays from various parts of India, and the adjacent countries.—Before proceeding to further details, I should here premise ■ few remarks on the existing common Pottery of Bengal.

The common native Pottery* of Bengal is formed of a clay, containing so much oxide of iron and carbonate of lime, that the vessels melt into a slag at a temperature little above that of redness.

No. 1. Common clay.
2 Do. fused at redness.

Deposits of a black stiff clay, containing much vegetable matter occur in many districts, vessels made from which sustain a higher temperature without fusion; but crack and warp so much, ■ to be of very little use.

Specimen No. 2.
a, Clay.
b, Do. heated.

Of true glazes for ordinary ware, the native potter may be said to be entirely ignorant. In many districts, mixtures are used of clays of very fine texture, easily reduced to powder, which are applied with care as ■ paint, and then heated till they adhere closely; but without fusion. This operation is rather painting than glazing, and though it renders vessels impermeable to fluids for ■ few operations, it is but a very inadequate substitute for the true vitreous coating.—The “varnish” in question may be scratched through by the point of ■ pin.

Specimen No. 3. Mr. Piddington's Serampore “glazed” ware.

In none of the native furnaces which Buchanan described, (See the Vol. on Bohar) or which I have myself examined, is there such a disposition or arrangement ■ would admit even of the most fusible lead glaze being successfully employed. The Pottery being burned in direct contact with the fuel, the oxide of lead would necessarily be reduced to the metallic state, and no glazing could be performed.

My object in commencing these experiments was, in the first place, in conformity with the wishes of the Honorable the Court of Directors, to procure common and cheap vessels, combining the following properties :—

1. Mechanical strength.
2. Infusibility at high temperatures.
3. Lightness of colour.

* The marginal notes refer to the specimens which accompanied this Report

4. Impermeability to water, oil, and ordinary culinary liquids.

5. A cheap glazing, free from lead or any other deleterious substance, and capable of resisting corrosive chemical fluids at high boiling points, and under long continued heat.

The first step towards succeeding in these objects was the procural of suitable clays;—these should combine—

A. Ductility under the lathe.

B. Infusibility.

C. Regularity of contraction, &c. in heating.

D. Burning to a pale colour.

On reference to Buchanan's admirable work, descriptions were found of clays occurring in the Rajmahal and Bhagulpore hills, and in the neighbourhood of Patna, which seemed to promise the qualities desired.

A strict search in the Museum of the Asiatic Society only led to the finding of one promising clay marked "Cherra-poonji," evidently a felspathic earth, proceeding from decomposed granite.

Letters were accordingly addressed to the under-named gentlemen, soliciting their co-operation in procuring supplies of clay for examination on a large and practical scale, and setting forth the local and general benefits which must accrue from the successful prosecution of this inquiry.

Mr. Oman, indigo planter, Colgong; Dr. Lockie, civil surgeon, Bhagulpore; Mr. W. B. Johnson, opium department, Patna; Dr. Davenport, civil surgeon, Cherra; Lieut. Braddock, gunpowder agent, Madras; Mr. Jas. Colquhoun; Mr. Blundell, commissioner of the Tenasserim provinces, Moulmain; Messrs. Lauderston and Co. Calcutta. The last parties were addressed with reference to the clays of Moulmain and Singapore, in consequence of information I had received of the existence of white clays in great abundance, and in situations of ready accessibility at both these localities.

By the replies received from all the gentlemen addressed, and copies of which are appended, the Government will observe the zeal, interest, and liberality with which the subject was taken up.

Specimen 4 On the 10th May, Mr. Oman forwarded a specimen of white clay, *Khari*, obtained from the Modiram Hill, one mile from his residence. He described the quarry as extensive, the clay procurable in any quantities, the quarry about a mile from the river, *never worked; and almost unknown to the natives of the place.*

Specimens 5, 6. Mr. Oman also forwarded two other specimens. 1. *Garia Mittee*, [coarse steatite.] 2. *Saboon Mittee*, a dark brown clay, strongly resembling "*fuller's earth*," occurring on the same hill, and used by the natives as a substitute for soap.

On the 19th May, Mr. Oman despatched 28 maunds of the white earth, *Khari*, and 11½ maunds of the brown clay; the consignments reached Calcutta safely in 18 days.

Dr. Lockie's Specimens. Dr. Lockie, of Bhagulpore, was kind enough to forward specimens:—

1. Kullee, identical with, and from the same locality, as Mr. Oman's *Khari*.
2. A similar clay from the Rajmahal district.

3. Ditto, locality uncertain, ■ bazar specimen.
4. Gohurthapulla, *slentite*.
5. The same ■ 4.
6. Gourao ditto.

Of the specimens sent by Dr. Lockie, as will be subsequently explained, Nos. 1 and 2 were alone deemed of practical value; but ■ these were sent in large quantities by Mr. Oman, there was no further need for having recourse to Dr. Lockie's willing and ever ready aid.

Mr. Davenport sent four specimens. No. 1 and 3, which promised to be the best were marked "not abundant." No. 2 was identical with the black clay of Bengal. No. 4, decomposed granite, strongly impregnated with iron. Mr. Davenport considered that the cost of the clays sent to Calcutta, during the rainy season, would be eight annas the maund; but he stated that the scarcity of coolies would render it necessary to use Government cattle for the procuring of the clay ■ any extent.

Mr. Johnson of Patna wrote as follows, in despatching the clays marked 8, 9, and which had been described by Buchanan in his account of the Statistics of Behar:—

Extract from Mr. Johnson's Letter.

"Agreeable to your request, I have despatched by Dawk and by Banghy, specimens of the clay. It is procurable at Phatuah, on the south side of the river. There is an excellent clay procurable at Peorpointee; also a good clay at Behar, and at Allygungo Sewar, near Ohuprah, of which I will try and procure specimens for you. I have given directions to the sirdar of the third fleet to take you a basket of the first mentioned clay, the cost of which ■ very trifling; the boat hire and landing would be about 12 or 13 rupees per 100 maunds."

A notice of the quality of this clay occurs in another place. It has proved of little or no value.

Mr. Piddington, of Calcutta, having supplied ■ with ■ specimen of clay from Rhotas on the Soane, and informed me that it was used by Messrs. Boyd and Co. in considerable quantities in their ■ sugar establishment, I addressed that firm for a supply, which they very kindly and promptly furnished. The clay contains 7 per 100 of chalk. Samples are given of the clay in the ■ state, and after it has been exposed to intense heat, which causes ■ partial fusion and spongyness of its texture.

Mr. Blundell's reply to my letter reached ■ late in July, and accompanying it were four bags of clay from Moulmein and Mergui. ■ subjoin an extract from Mr. Blundell's letter:—

"The quantity (of all specimens) appears to be unlimited, and easy of access, being generally the stratum of low hills; the expense of collection very trifling, of conveyance to Calcutta about 20 rupees the ton. The earth is not used by the Natives for their potteries, and is only resorted to by the soldiers as pipe clay."

The clays were all white, free from lime ■ iron.—No. 1, very sandy or micaceous. No. 2 extremely soft and ductile—all very refractory, and burning of a white colour; but the ware cracked irregularly, and ■ devoid of cohesion when fired. No. 1 and 3 resembled very closely the *Khari* of Culgong.

The late Lieutenant Braddock of Madras, ■ the 20th August, forwarded

*Lieut. Braddock's
Madras Specimens.*

seven specimens of clay and pottery, with the subjoined remarks:—

"I have the pleasure to acknowledge yours of the 6th instant, requesting specimens of the earths and clays about Madras, I have herewith the pleasure to send you some. We have no great variety.

"No. 1.—A fire clay from Sroopermater, about twenty-eight miles from Madras.

"No. 2.—Variety of ditto.

"No. 3.—Crucible clay from Yorra Mootoopollam, about 15 miles from Madras.

"No. 4.—Variety of ditto.

"No. 5.—Clay used at Madras for the common pottery of the bazar.

"No. 6.—A broken piece of a vessel made of ditto.

"No. 7.—A broken piece of a vessel said to be made at Arcot.

"I shall make further inquiries about Pottery clays; but I am of opinion that these varieties include all that are in use here. If I should get any further specimens, or any further information that might be useful to you, I will let you know."

In a subsequent letter, Lieut. Braddock added,

"I have herewith the pleasure to send you a specimen of earth said to be obtained at about 60 miles from Madras. It is brought that distance, and made here into white poggles, (vessels for water); but different (probably) from the piece of white pottery I sent you, i. e. this clay is probably different from the clay of which that piece of pottery ■ made. Of this, however, you will be able to judge by analysis."

Of these clays, Nos. 1 and 2 correspond closely with the Colgong khari. Nos. 3 and 4 with the Patna Phatuah, and No. 5 with the common clay of Bengal.

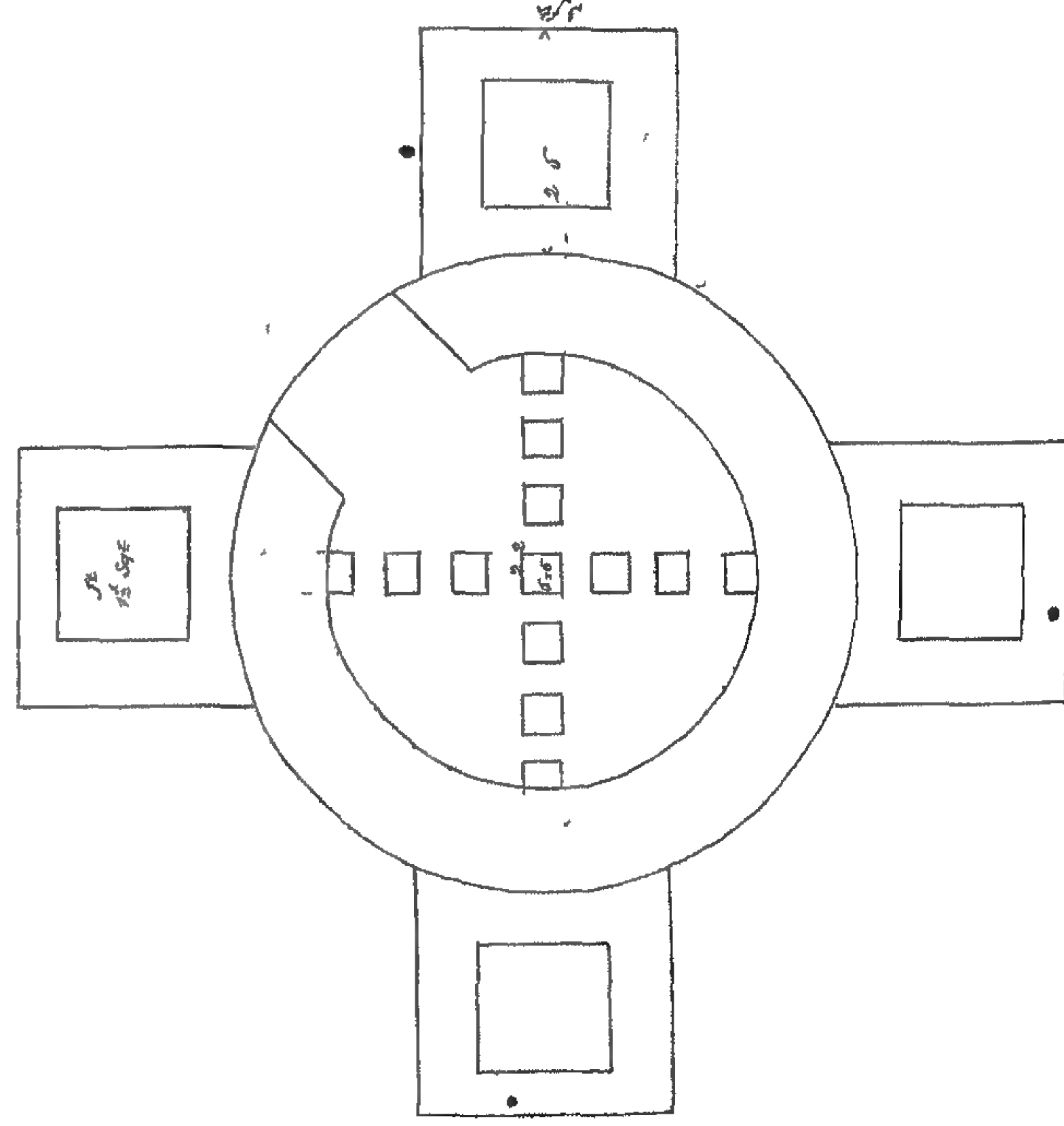
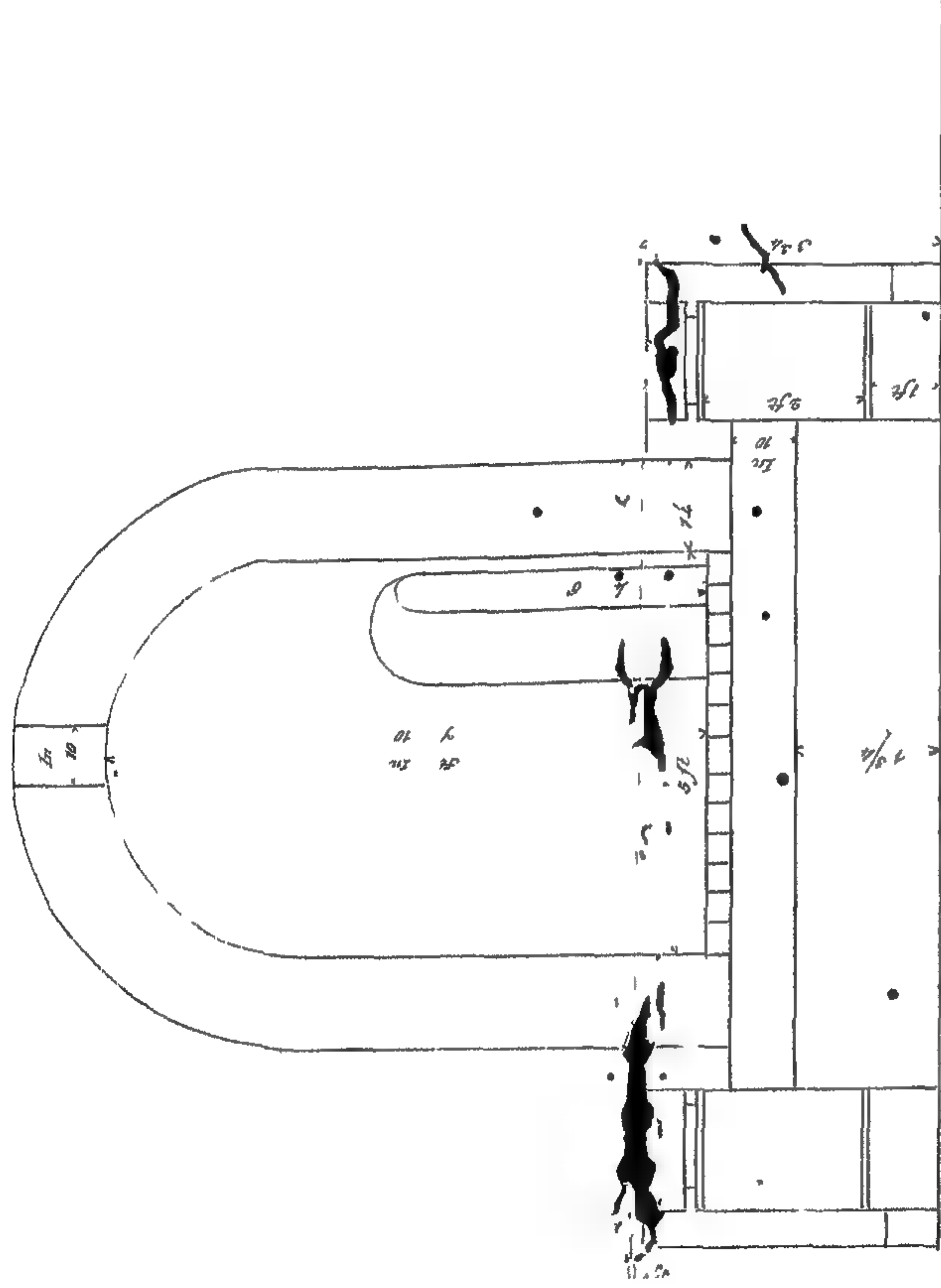
Of the two specimens of pottery, the red is inferior in appearance and texture to the common Bengal ware; the whiter kind is strong, and shows plainly, that if properly prepared and heated, the clay of which it is composed, would give a very superior article of ware.

In October 1840, Captain Halsted of her H. M.'s brig *Childers*, kindly favoured me with several specimens, some from Mergul, which were almost identical with Mr. Blundell's; but there was one from Singapore by far the most valuable of any I had before met with.

This clay is white externally, mottled red within, contains large nodules perfectly white, is smooth and unctuous to the touch, readily forms a fine paste with water, is ductile and plastic ■ the lathe, perfectly refractory in the fire. The white parts yield ■ strong close white biscuit. The whole clay ground together gives ■ biscuit of a pale yellow colour, hard enough to strike sparks from steel, and without glazing quite impervious to water.

TRIALS OF THE CLAYS.

Reserving further details regarding these clays for another report, I placed to notice the steps I took to subject them to a fair working trial.



An expert native potter, Bonomallee Paul, was engaged ■ a salary of twenty rupees per mensem. He was encouraged to ■ the common implements of his trade, as far as concerned the preparation of materials and their mechanical construction. I adopted this plan in preference to the use of any expensive apparatus, from the conviction, that improvements in this art (as in others) to be generally diffused through the country, must be of that kind, which involves no great outlay of funds, and as much as possible interwoven with methods and contrivances with which the people are familiar.

The potter's wheel is of the simplest kind, and has been perfectly described by Buchanan. I shall not repeat what he has said—suffice it to say, that a horizontal fly wheel, the frame of wood, the rim heavily laden with clay, two to three feet in diameter, weight sixty to eighty lbs. is put in motion by the potter's hand, assisted by a stick; once set spinning, it revolves for from five ■ minutes with a perfectly steady and nearly *true* motion. The mass of clay to be moulded is placed on the centre of the wheel, and the potter squats before it on the ground.

This machine has doubtless several defects; but it answered my purpose perfectly. My object was but to test the qualities of the clays, and to construct small vessels. Any favourable inference in favour of a ware prepared ■ such a wheel, would leave no room to doubt the result on adopting the European form of apparatus.

Furnace.

The native furnace is simply an excavation ■ the ground, of variable depth, in which the ware ■ placed layer by layer, with dry reeds, straw, &c. and all are burnt together. This rude system must of course give way to the European method, for the construction of all the superior kinds of vessels.

A biscuit furnace of which I forward a plan and section, was erected in the laboratory yard. It consists of ■ cylindrical dome, five feet in internal diameter, seven feet ten inches in internal height—four fire-places ■ disposed at equal distances all round, each fire-place is twenty-four inches deep to the grate, two feet six inches square area, and opens by a flue under the floor of the cylinder.

The fire-places and cylinders are lined with fire-brick. An entrance was left for the arrangement of the ware. This entrance is walled up on each experiment. The top of the dome opens by an aperture eighteen inches square into a horizontal flue, leading to one of the laboratory chimnies, thirty-five feet in height.

The expense of this furnace ■ Co.'s Rs. 650.

The temperature attainable ■ that of a white heat of iron, by the combustion of ten maunds of Burdwan coal and six of wood. It was sufficient to fuse all common glazes, and to bake ware to the consistence and hardness of striking fire from steel. It was scarcely sufficient, however, for the porcelainous fusion of any of the earths under experiment.

For this purpose, I have hitherto been compelled to employ the common draught furnace of the laboratory, burning the trial pieces ■ muffles ■ saggars. I have now, however, completed a glazing furnace on the ■ plan ■ that already described, but the dome being of much smaller dimensions. In this my future experiments on glazes and enamels will be conducted.

Analysis of the Clays.

The experiments under this head, were performed by Nobin Chunder Paul, one of the past Students of the Medical College, and an expert and careful operator.

A qualitative analysis ■ first made in each instance to ascertain the presence or absence of lime, magnesia, or iron; subsequently ■ certain portion of the clay was carefully subjected to the action of the gaseous hydrofluoric acid, and the loss of silica ascertained. As these experiments will form the subject of a separate paper, I shall reserve the results to which they led for description in that document. The analysis indeed was comparatively of remote interest, as we had to investigate exclusively, in this stage of our inquiries, the *mechanical* properties of the several clays ■ obtained. Much more speedy and practically useful results were always obtained from the preparation of ■ few cups of thin ware, from each of the clays under trial, than from the nicest analysis. This has still, however, a high degree of interest, when we consider the ultimate perfection of our processes, and the adoption of the ornamental branches of the art; and it will accordingly receive full attention as ■ proceed.

Practical Trials of the Colgong Khari.

N. B.—The remarks under this head apply also to the Moulmein clays, Nos. 1, 3, 4,—the Mergui No. 2,—the Madras, Nos. 1 and 2—the Bhagulpore, Nos. 1, 2, 3,—and the Cherra, No. 1.

These clays occur in shapeless blocks, white, harsh to the touch, free from smell, absorb water with a loud hissing sound, and fall to pieces in slate-like layers. The moistened pieces are easily reduced to pulp under water. This operation was performed in our experiments by the hand, and by beating with a wooden pestle in ■ stone mortar. The creamy liquid was strained through calico, and thus all pebbly, coarse, micaceous and sandy particles were removed.

A paste of this clay was worked with difficulty on the lathe, being but little plastic or tenacious; ■ burning, the trial vessels prepared from it cracked and fell to pieces. The colour after baking was a pure white or pale pink tinge.

Such clays are evidently unfit by themselves for the manufacture of earthenware.

Specimens. They afford an admirable natural substitute for the ground *flints* of the English stoneware manufacture; but they require a more ductile material to be mixed with them.

Experiments with the Colgong "Saboon Mittee," or Fuller's Earth.

This earth is brown, easily reducible to pulp, very ductile and tenacious, exceedingly refractory, but burns to ■ deep brick colour. It gave good vessels as far as density and tenacity were concerned; but they were liable to crack, and of a dirty disagreeable colour.

Mixtures of both the preceding Clays.

The potter having reported, that a very small portion of the saboon mittee mixed with the khari, gave this the proper tenacity for the lathe, the following mixtures were made up for firing in the biscuit furnace :—

■ Khari. Parts.		Parts Saboon Mittee.	
No. 1	16	.....	0
2	16	.....	1
3	16	.....	2
4	16	.....	■
5	16	.....	4
6	16	.....	5
7	16	.....	■
8	16	.....	7
9	16	.....	■
10	16	.....	9
11	16	.....	10
12	16	.....	11
13	16	.....	12
14	16	.....	13
15	16	.....	14
16	16	.....	15
17	16	.....	16

The mixtures were modelled into cylindrical vessels all of the same size, and after drying for an equal time, were heated together in the biscuit furnace. The following are the results obtained :—

No. 1 (Km. 16, S.m. 0). Fell to pieces, fragments white, crumbling to powder on pressure.

No. 2 [Km. 16, S.m. 1] White, much cracked, brittle, very soft.

No. 3 [Km. 16, S.m. 2] But little different from No. 2.

No. 4 [Km. 16, S.m. 3] White, dense, very slightly cracked, soft, but little cohesive.

No. 5 [Km. 16, S.m. 4] Paint tinge of pink, texture smooth, dense, and strong; no cracking, very hard where heat was greatest and at the edges.

No. 6	Km. 16, S.m. 5	} But little different from No. 4.
7	Km. 16, S.m. 6	
8	Km. 16, S.m. 7	
9	Km. 16, S.m. ■	
10	Km. 16, S.m. 9	} Colour pink, texture close and strong.
11	Km. 16, S.m. 10	
12	Km. 16, S.m. 11	} Yellowish, red, hard, strong and light.
13	Km. 16, S.m. 12	
14	Km. 16, S.m. 13	} Deeper and closer than two last Nos.
15	Km. 16, S.m. 14	
16	Km. 16, S.m. 15	} Brick red, hard, dense, light and strong.
17	Km. 16, S.m. 16	

From these and many similar experiments, it was evident that in the mixtures of the two Golgong clays, Khari 4, Saboon 1, we have the materials for the manufacture of stoneware and of all culinary and chemical utensils, in which a pure white colour is not a desideratum, and strength, hardness, density and infusibility are the qualities required.

The colour of the ware producible from these mixtures, is buff to pale pink.

Of this ware in biscuit very beautiful vases, coolers, water gogols, and bottle holders may be constructed. I have kept such articles for three months in water, without their texture being injured.

Lastly ; for crucibles, fire-bricks, and fire-cement, these materials cannot be surpassed, and they thus afford the native and local manufacturer cheap substitutes for articles which have hitherto been imported from Europe at an extravagant outlay. Fire-bricks — an average cost in Calcutta ten rupees the hundred. With

*Specimens forwarded
of bricks & tile.*

these clays, as good bricks can be made and sold at a fair profit for 2 rupees 8 annas the hundred.

Rotas Clay.

This earth, from the large quantity of carbonate of lime it contains, is unfit for ordinary pottery ; but when very intensely heated, it yields a beautiful buff porcelain. I reserve it for further experiments on the superior kinds of ware in the second furnace now finished.

Moulmain Clay.

2, 3, and 4, of Mr. Blundell's specimens may be substituted in every way, for the Colgong Khari. No. 3, gives ductility to the paste ; but the vessels I have yet made with this mixture, have cracked in the firing. I hope in subsequent trials to be enabled to remedy this evil.

Madras Clays.

Of these 1 and 2 correspond to the Khari of Colgong. None are plastic enough for the lathe ; but with a fourth part of the "fuller's earth" of Colgong, they will make excellent common ware.

Singapore Clays.

By far the best clay I have met with, is that given me by Captain Halsted, and which he procured at Singapore.

It occurs, as I — informed, close to the beach, and the Messrs. Jaekorstoen of Calcutta inform me, it — be brought to Calcutta for six annas the maul.

This clay is found in thick strata. The detached masses are of a pink tint, broken into they contain nodules of perfectly white earth. They absorb water eagerly, and yield an exceedingly soft, ductile, and tenacious paste.

On firing, this clay is found to resist a temperature sufficient to fuse English blue pots. The vessels made from the coarsest parts of this clay are strong, hard, of a beautiful and rich crimson colour. The *picked* clay gives a snow-white biscuit; unpicked and simply worked up as it is dug, it gives a light yellow stoneware of the very best kind, as far as density, hardness, strength, lightness, and colour are concerned,

Specimen.

Trials of several Glazes.

In noticing this subject, I beg leave to refer again to a previous paragraph, in which I have described the qualities of what I would consider to be a good glaze.

To glaze the common Koggeroo-ware of Bengal, I look upon as a vain attempt. It is so fusible itself, that no glaze but one containing ■ unusually large proportion of lead could be employed at all. Such vessels must prove detrimental to health, and useless in chemical operations.

My first attempts at producing a glaze free from lead, ■ made with the sajoo mittes, or soda clay of Bengal. This well-known mineral contains about 50 per 100 of carbonate of soda with alumina, sand, carbonate of lime, and oxide of iron. On being heated nearly to whiteness, it fuses, effervesces and runs into a green glass. By increasing the proportion of sand, a good bottle glass is obtained, which though green in mass, is transparent and colourless in thin pellicles.

By reducing the mineral to very fine powder, and mixing the powder with weak gum-water, the Colgong biscuit-ware is readily made to take ■ a uniform coating of the material, either by immersing the vessels in the mixture, or applying this with ■ brush. The glaze readily fused; but to my regret, I found after numerous and tedious trials, that its rate of contraction on cooling differed so much from that of the clays employed, that it invariably cracked and peeled off, despite of the most careful annealing of the ware.

I have much pleasure, however, in reporting, that I have still succeeded fully in my object, and have obtained a glaze, combining all the qualities I desired. The glaze has never been used before; at least it is not mentioned in any work or essay on pottery to which I have access.

New Glaze—the Borate of Lime.

After failing with the soda earth, I next turned my attention to borax, (the bi-borate of soda,) and the compounds of boracic acid, with earthy and metallic bases.

I accordingly prepared specimens of the borates of lime, magnesia, alumina, lead, iron, tin, &c. Thin pieces of biscuit-ware, four inches long by two broad and one-eighth thick, were made of the Colgong clay mixture, 4 K. 1 S. and the several borates tried on these in a furnace capable of melting cast iron, and regulated by ■ register in the usual way.

Borax alone fused, glaze irregular and blistering.

Borate of Lead, fused, glaze regular, but cracked ■ cooling.

Ditto of Magnesia, infusible.

Ditto of Alumina, ditto.

Ditto of Lime, fused, glaze smooth, uniform, did not crack.

These were the results of several trials, and the superiority of the borate of lime was so manifest, that my attention was thence directed to ascertaining its applicability on a larger scale.

I find that it is most easily applied to our ■ biscuit, by mixing the powdered borate into a thin cream with weak solution of the ■ bazar gum. This mixture is applied with a brush, and the ■ is then exposed to the sun, or kiln-dried.

To fuse this glaze, requires ■ somewhat higher temperature than that needed for the preparation of the biscuit. The glaze being, when properly prepared, transparent and colourless, it leaves the vessel of its natural tint, and as lustrous as the best English ware. I submit herewith a specimen of the glaze applied on a stone-
Specimen. ware paste. The specimen in question has been boiled for two hours in the strongest sulphuric acid, and for the same period in nitric and muriatic acids, and yet it has not suffered in the least degree. These qualities render it of extreme value for the manufacture of vessels for the operations in chemistry and in the arts, in which corrosive liquids are concerned.

The lime solution is prepared by dissolving shell lime in bazar vinegar, till a neutral liquid is obtained, and boiling this down to the consistence of a thin syrup. In working a pottery, the impure pyroligneous acid would be employed and prepared on the spot. In ■ subsequent paper, I will show how this may be made a source of considerable profit to the potter.

The solution of borax is made by dissolving 1 lb. of sahaga, (bazar borax,) in 12 quarts of warm rain water, and straining through clear gunny cloth. This solution is to be added to the lime solution, in portions of a pint at a time, so long as any precipitate occurs.

The milky fluid is next to be thrown on a calico strainer. The solid matter, which is already finely pulverulent, should be washed with cold rain water, again strained through calico, and dried for use.

The minute quantity of this article required for the glazing of a vessel, renders its expense scarcely worth calculation.

By the preceding experiments, I conceive that I have fulfilled the task I was set, in ascertaining the feasibility of introducing into India the manufacture of superior articles of common pottery, for culinary and chemical purposes—and for the packing and conveyance of medical stores. The materials requisite have been found in accessible sites; their cheapness and abundance shown; their *mechanical* properties investigated; and the practical circumstances studied, essential for the commencement of the manufacture by the common potters of the country. It remains for me, in future experiments, to attempt the production of the finer and more ornamental kinds of articles, and to study the fitness of our ware to receive coloured glazes, gilding, &c. after the European and Chinese methods. This, however, I look upon as a matter of very secondary importance, contrasted with the results already gained.

It is necessary too to observe, that all the specimens I have had made up, have been either hand-made, or turned ■ the native potter's wheel. They consequently want the finish which machinery can alone impart. The density of structure too is much less than it would be in a large factory, where *great quantities* of materials could be stored for *long periods*. The influence of these two circumstances in causing the better union of the clays and compactness of the work, ■ well known to potters in all countries. I may thence reasonably conclude, that, if in my experiments on *pounds* weight, and performed as soon as the materials could be mixed, we succeeded in producing ■ ware impermeable to liquids, and hard enough to strike fire from steel, large and long continued operations must materially improve all these good qualities.

I have lastly to represent respectfully, that in these and similar experiments, I can only engage to point out to Government and to individuals, how a certain manufacture may be undertaken. I cannot offer, for example, to supply from my own small furnaces any portion of the ware the public stores may require. I can only show others how to make it, and then leave these to the manufacture themselves.

A very trifling capital will suffice to start a small pottery. Of the 600 rupees charged for the College furnace, 260 were for English fire-brick. Now this item would be reduced to one-fourth by making bricks of the Colgong materials. The clay may be brought to Calcutta, in large quantities, for six annas the maund.

The expense of two furnaces, biscuit and glazing, with chimnies, sufficient for the commencement of a considerable trade, I estimate at 1,000 rupees.

I leave it to others to consider whether it would be expedient to have a separate factory to give the supply needed by Government. I would in preference recommend that a contract be offered to the Native potter I have taught, and a small sum of money lent him on adequate security to encourage him to commence. He is intelligent, honest, and of good character in his trade.

I should not conclude this Report without prominently stating, that I have seen a fragment of excellent salt glazed stoneware, bearing the stamp "Puttuygurh," and which I am informed, was manufactured by Mr. Jeffreys, late of our Medical Establishment. I have been unable to procure any information as to the materials this gentleman used, the processes he employed, or the expense of the vessels. The manufacture has been abandoned since Mr. Jeffreys' departure from India.

W. B. O'SHAUGHNESSY, M. D.

MEDICAL COLLEGE, 15th December, 1840.

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Catalogue of Specimens of Native Clays, Pottery, and Fire-Brick, submitted to Government with the Report.

1. *a.* Common Bengal potter's clay.
1. *b.* Ditto, fused at a red heat.
2. Another Bengal clay, more infusible than No. 1; but at a full red heat it swells and cracks, as seen in the specimens.
3. A specimen of a ware made at Serampore, and having a varnish, (not a glaze,) to render it impermeable to fluids, presented by Mr. Piddington, with a memorandum of the native process.
4. Colgong white clay, (KHARI.) This constitutes the body of the new stoneware proposed in the Report.—It is a perfect substitute for the ground flint of European stoneware.
5. The same clay, after being subjected to a fierce white heat for several hours.
6. Colgong soap clay, "fuller's earth (SABOON MITTEE)."—This constitutes a fourth part of the new ware.
7. Khari clay from Bhagulpore, identical with No. 4.
8. Steatite from Bhagulpore.

9. *Geru muttec*, a silicious clay from Bhagulpore, very refractory in the fire, and makes good ~~ware~~ ware with ■ fourth part of Colgong soap earth.

10. A clay resulting from decomposed granite, obtained from Chorra Punji. Though of little value, it shows the probability of much superior clays being found in the same locality.

11. A clay from Chorra Punji, described in Dr. Davenport's letter, "as not abundant,"—of very good quality.

12. *Phatua clay*, from the bank — of the Ganges, described by Buchanan; gives ■ good common ware, but ■ very easily fusible.

13. Clay from Rhotas Guh, contains 8 per 100 carbonate of lime, and is very fusible. Will afford a useful material for the manufacture of porcelain.

14. The same clay, softened at ■ full red heat.

15. *Borate of lime*, the substance recommended in the Report as a glaze for the new stoneware.

16. }
17. } Clays from Moulmoin, described in the Report.
18. }
19. }
20. }

21. } Identical with the Colgong khari. }
22. } } Madras Specimens.
23. } A good crucible clay. }

24. The same as khari.

25. Common Madras potter's clay.

26. Common pottery of Madras.

27. Finer pottery from Arcot.

28. Singapore clay.

29. A small cup of stoneware, made of three parts Colgong *khari* and one part Colgong *soap earth*, glazed outside with *borate of lime*. This specimen has been heated to the melting point of cast iron; is hard enough to strike fire from steel, and has been boiled for two hours in nitric acid to prove the stability of the glaze.

30. A lighter kind of stoneware, of similar composition.

31. A cup made of the Colgong soap clay, fired at a white heat, colour brick red. This ware would make excellent saggars or cases for the firing of fine pottery, porcelain, &c.

32. Singapore clay, a cup fired at a white heat. This clay gives a very beautiful pink biscuit.

33. A cup of the red clay of Bhagulpore, fired at a white heat.

34. A cup of Singapore clay, from which the coarser red pieces had been picked out—perfectly white.

35. A cup of Chorra Punji clay of the same properties as No. 32.

36. A cup of *Phatua clay*, fired at a red heat.

37. Cup of ■ black clay, exposed to a low red heat.

38. Fragments of stoneware made of Colgong clays, glazed by *salt* after the English method.

39. A jar of biscuit stoneware, made of Colgong clays.

40. } Porous biscuit-ware of ■ materials.
41. }

42. }
43. } A tile and two bricks made of same materials. See Captain Wilson's report.
41. }

45. Ditto ditto.

These specimens have been exposed to the fiercest heat of a powerful draught furnace, which melted down blue pots and American fire-bricks. They have been hastily and roughly made up; but are in every respect equal to the best English fire-brick, and can be prepared at three rupees the hundred. The English brick costs (average) ten rupees.

W. B. O'S.

Calcutta, December 22, 1841.

Mr. Piddington's Memorandum, to accompany a set of Specimens of Varnish Earths.

1. In establishing an extensive Sugar Refinery, I was desirous of avoiding the heavy expense of English sugar moulds, and the draining pots on which they stand. I knew that common native pottery had been extensively tried by others, and that it would not stand the penetrating effect of the sugar when poured, as it is, boiling hot into the moulds, and left for weeks during the claying process.

2. My attention was naturally directed to the native sugar-boiler's and sweet-meat-maker's pans, called *kolas*. These I know were used for boiling sugar, and frying mixtures of sugar and ghee, (which must require a very high boiling point,) for weeks together, and many times a day; and I found that their destruction was always owing to cracks by heat; but that their varnish resisted every thing to the last. It was clear that this was the varnish I wanted, and I succeeded at last in obtaining it, and, by employing men as varnishers separately from the potters, in making sugar moulds, which though not so strong, would with care almost rival English ones at eighteen rupees per hundred. For those of the largest sized loaves, holding a maund and a half of syrup, I proceed to describe the earths and the process used.

3. I shall first mention, that the pottery was of the common red kind, sold in all the bazars, and made from the silt of the banks of the river; but the best *kolas* are made at Kulna, a little above Sooksaugor, on the Burdwan side. I know these are highly preferred and even carried into Jessore. I should mention that the oven is the common old-fashioned semi-elliptic one, open in front and at the top, such as is used for burning tiles in Europe and in India. The pottery is burnt at one firing only, being varnished when put into the kiln.

4. There are two kinds of earth used, of which specimen No. 1 is called *belutti*. It is a coarse siliceous ochry yellow earth, with veins and patches of a siliceous, aluminous earth interspersed through it. When washed, it leaves a residuum of small gravel, mostly siliceous, with a little felspar. The best soil is found at eight or nine coss from Kulna; but I have lost the name of the village.

From this *belutti* is prepared only one of the three varnishes used, and it is also called when prepared, *belutti*. It is sold at Kulna at one and a half rupee per

maund of raw earth, and two rupees per maund of prepared belutti. Fifteen days are required to prepare a quantity properly. No. 3 is sample of prepared belutti. No. 2 is the next sort of earth. It is called *ooporomee*, (or upper wash). It may be described as a strong brown tenacious or clayey loam. The best is found at a village called Monad, ten coss west of Chinsurah, and at Panchulowkie, eight coss S. W. of Kulna. The raw earth is sold at four annas the maund; but the prepared *ooporomee*, No. 4, is worth three rupees per maund. Three months are, they pretend, required for its proper preparation; and ten seers *ooporomee* are procured from each maund of the raw earth. There are also two other sorts of varnishing earth, prepared from this *ooporomee*, which are,

No. 5. *Gád*, or *seum*.—Though it is obtained at the bottom of the washing vessel, and No. 6, *Majaree*, (or middle sort.)

All these prepared specimens—belutti, *ooporomee*, *gád*, and *majaree* are obtained by washing, great care being taken to select the water of a very pure tank, no doubt to avoid saline mixtures, which would act as fluxes. The belutti when prepared, is a mixture of the yellow ochre and alumina in slightly variable proportions. The *majaree* and *gád* are the first settlings of the raw *ooporomee* when dissolved in water, and the *ooporomee* itself is the finer part, which remains suspended, and is separated by pouring off successive waters, when it slowly deposits.

The application of the Varnish Earths.—The ware being thoroughly sun-dried, is first smeared inside with the sort called *gád*, No. 5, which is diluted in water to the consistence of a thick cream. This smearing, for it is nothing else, is done by a rag. The ware is now again left to become thoroughly dry in the hot sun.

Upon the coat of the *gád* is smeared, in the same way, one of the prepared belutti, No. 3, and this is also allowed to dry. The ware now appears as if smeared over with a thin wash of yellow ochre, for it is not laid on to bring thickness.

Upon the belutti is again smeared a thin coat of the *ooporomee*, and by examining the sample of ware sent herewith, the effects of these smearings will be distinctly seen. It would appear, that the cream must not be too thin to disturb the coat below, nor too thick, nor thickly laid on, when I suppose it might run or peel off. The *majaree* is used in ordinary works in the place of the *ooporomee*, and it will be seen, that it is only a coarser variety of it.

I regret greatly that I had not time to examine these varnish earths; but I was much overloaded with work at the time, and have not been able to take them up since. A purely earthen varnish for common red ware, has always I think, been a desideratum. And in the hands of European chemists and potters, I have no doubt that this curious fact of the fusion of the varnish, by the aid of the carbonate of iron of the ochre, (which I take to be the flux of the mixture,) would be turned to account. I sent a set of these samples to the Society of Arts, and another to America, together with one to Mr. Jas. Prinsep; but by a singular fatality, all have been lost. At least I have heard nothing of them. The great value of this varnish seems to be its remarkable power of resisting long heat, and a very penetrating solution like that of sugar.

II. PIDDINGTON.

The fragment of a *kola* sent herewith, is of the best kind of them. The native *kola* is a small one from the bazar, and they say not of the best sort.

The process so clearly described by Mr. Piddington, is as good a substitute for a glaze, as could well be contrived. The coating is for a time quite impermeable, but it is so soft, that it may be scratched through with the point of a pin. I have not been able to melt mixtures in all proportions of the material. Mr. Piddington had the kindness to send me, in a furnace which fuses the body of the ware itself into a pumice-like sponge.

Extracts from a subsequent Report.

Pottery.—The experiments on pottery have been persevered in, especially on the Singapore clays. Of these No 1 has afforded a beautifully white biscuit, which stands the fiercest heat without cracking.

I have also prepared several specimens of fire-bricks, and have the pleasure to append the report of Captain Wilson, of the Cossipore Foundry, and Major Forbes of the Calcutta Mint, on the trials made of the bricks at these establishments.

Information has been received, that the Colgong clay quarries are to be had for an annual rent of twenty-six rupees the year, and measures are now being taken, which will ensure a cheap source of supply of good glazed stoneware, fire-cement, crucibles, and fire-bricks, for the use of Government, and the public at large.

1st May, 1811.

W. B. O'S.

REPORTS ON NEW FIRE BRICK.

TO W. B. O'SHAUGHNESSY, M. D.

Chemical Examiner to Government.

Sir,—I have been favoured with the receipt of your letter of the 19th instant, with the specimen of fire-bricks made under your superintendence, and I beg to congratulate you on the perfect success of your experiment. I tried a portion of the brick yesterday, and it withstood the fiercest heat as well as the English, and they appear to me only to want a greater compression in the moulds, to render them equal to the best English fire-bricks.

The specimen you sent me on being cut through, showed a want of solidity and compactness in the centre, which by the application of a more powerful pressure, could, I imagine, be easily remedied.

I have &c.

(Signed)

A. WILSON, Captain,

Officiating Superintendent and Director of Foundry.

Cossipore, 22d April, 1811.

No. 30 of 1841-42.

To W. B. O'SHAUGHNESSY, Esq. M. D.

SIR,—I have the honor to acknowledge the receipt of your letter of date the 19th ultimo, forwarding a specimen of fire-brick, prepared under your superintendence, from materials obtained at Colgong, and having had it subjected to trial, you will perceive by the accompanying Report, that although not quite equal in quality to Stourbridge fire-brick, it has been concluded that its inferiority is mainly, if not alone, attributable to the comparatively imperfect mixture of the substances of which it is composed.

I have the honor to be, Sir,

Your most obedient servant,

(Signed) W. N. FORBES, *Mint Master.*

CALCUTTA MINT, the 15th May, 1841.

10th May, 1841.

Made a trial on fire-brick sent to the Mint by Dr. O'Shaughnessy, and said to be prepared from materials raised near the river at Colgong, and consisting of 3 parts of Colgong *khari* clay, and 1 part of fuller's earth, *saboon muttee*.

The brick was placed on its end in one of the Mint parting furnaces, with another, *Stourbridge* fire-brick, and fired on with coke to the greatest strength the draft would admit of, for five hours, and remained to cool down the next day. On examining the bricks on the following day, it was found that the *Stourbridge* brick was completely vitrified; but had not lost its figure. The Colgong brick was also vitrified, and had lost its figure on one side, it having run into holes; but on the other side, one of the original letters, which the brick was marked with, remained a very little disfigured. Previous to putting the brick into the fire, I observed that the materials composing it had not been well mixed, and which I think accounts for the irregular wasting that took place.

I think the Colgong fire-brick good, but inferior to the *Stourbridge*; but I think the Colgong fire-clay would answer in most cases where *Stourbridge* clay is used.

(Signed) J. GILBERT.

(A true Copy.)

W. N. FORBES, *Mint Master.*

CALCUTTA MINT, the 12th May, 1841.



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